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The Karnatak University Publication No. I.*

PLEISTOCENE STUDIES IN THE MALAPRABHA BASIN

BY

R. V. JOSHI

POONA 1955 DHARWAR

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OFFICE OF THE DIRECTOR OF ARCHAEOLOGY
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Deccan College Research Institute and
Karnatak University Publication No: 1

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BY

R. V. JOSHI

PLEISTOCENE STUDIES IN THE MALAPRABHA BASIN

BY

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FOREWORD

Dr. R. V. Joshi who was a student of the Deccan College, Poona, in 1949-52, carried out the survey of the Malaprabha River and his thesis 'Pleistocene Studies in the Malaprabha Basin' was accepted for the Ph.D. Degree of the University of Poona, early in 1954.

It was about this time, that the Karnatak University started the department of Geology of which Dr. R. V. Joshi was appointed Reader. Provision has been made in this department for the study of Geochronology, facilities for the study of which do not exist in any other Indian University, at present. This very brief narration of events underlines the need for co-operation and collaboration in all Indian Universities whether they relate to one regional unit or several, between the various Universities and other Institutions of higher studies, for, there is a great dearth of trained personnel and finance. It was with this aim and with a view to furthering joint work in the field of pre-history in which the Deccan College has taken the lead since 1941 and in a branch of which the University of Karnatak wishes to specialize that a joint publication of Dr. R. V. Joshi's work was thought of.

This is the first work of its kind in India and perhaps the first joint publication of two different regional institutions. It is hoped that the example here set-forth would be followed elsewhere in India with good results.

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Vice-Chancellor,
Karnatak University,
Dharwar.

S. M. Katre,
Director,
Deccan College Post-graduate &
Research Institute, Poona.

PREFACE

In this book I have made an attempt at finding the details of the Prehistoric Man of Karnatak whose cultural remains—the palaeoliths—have been noticed practically in every river basin of the Karnatak. The evidences regarding the environmental conditions prevailing at the time of first habitation of this part of the country are, however, extremely rare and widely scattered. With a view to ascertaining these, it is necessary to cover larger area than that has been actually traversed by me. The region seems to be quite promising and it is hoped that a sustained research would throw more light on these unsolved problems of Indian Prehistory in general and of the Karnatak Prehistory in particular.

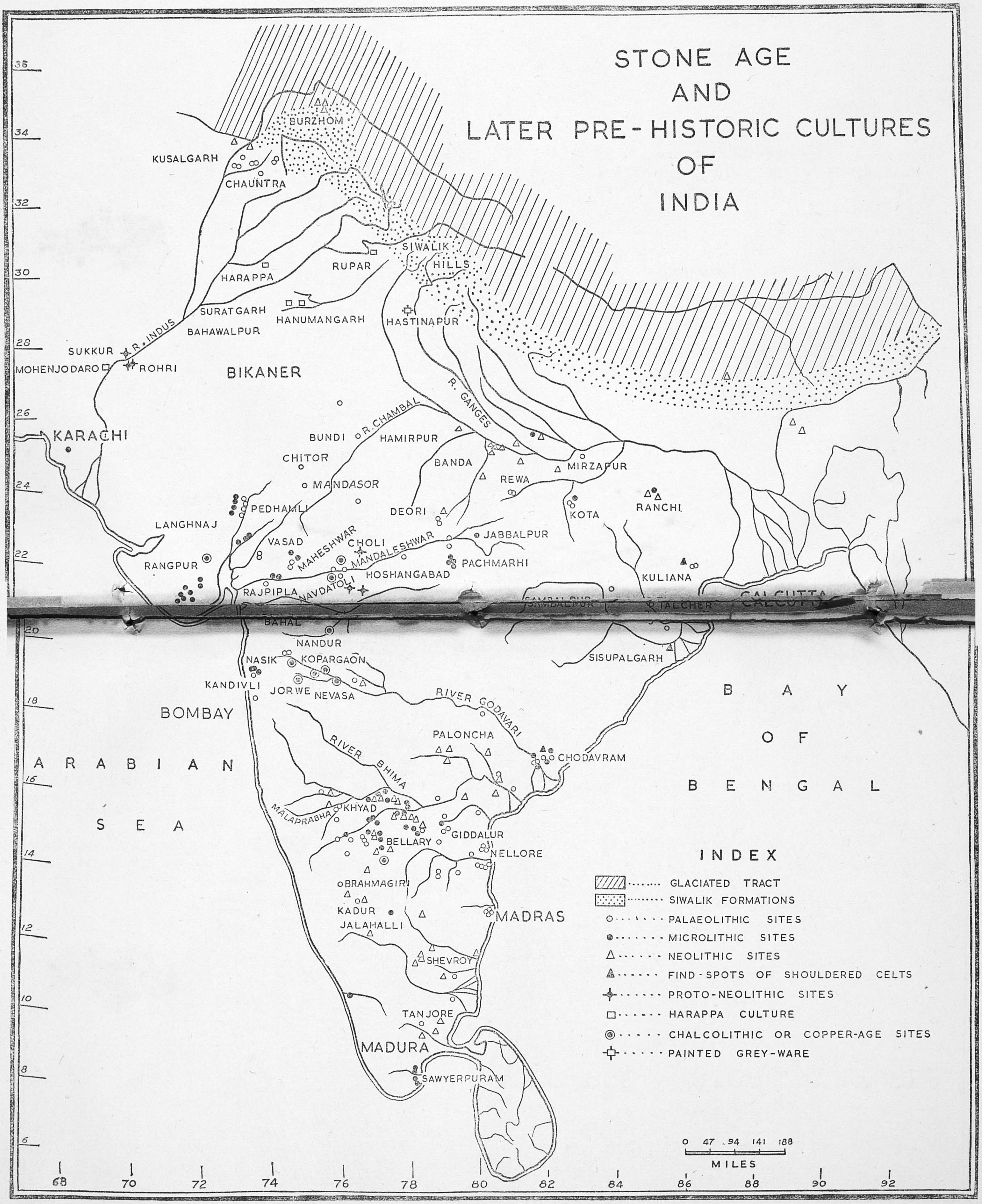
It is always a pleasant duty to express one's gratefulness to all those who helped in one's undertaking. I had the good fortune of accompanying Dr. F. E. ZEUNER, Professor of Environmental Archaeology at London University, to the Malaprabha river when I received my first lessons in the prehistoric archaeology and geochronology. He not only initiated me into these subjects and encouraged me to carry out a detailed survey of the pleistocene deposits of this area, but also gave very valuable instructions while my work was in progress. I am grateful to Dr. H. D. SANKALIA, Professor of Proto-Indian and Ancient Indian History, Deccan College Post-Graduate and Research Institute, Poona, who guided me in the planning and execution of the work, and extended facilities for field studies on the Pravara, Godavari and Narbada rivers. My grateful thanks are also due to the authorities of the Deccan College for giving me all kinds of facilities during my research.

I thank Shri. Shaikh ZAINUDDIN, M.A., Deccan College, Poona, for his help in the preparation of drawings of illustrations.

I express my deep gratitude to the authorities of the Karnatak University, Dharwar, and of the Deccan College, Poona, who undertook the publication of this book.

POONA,
24th March, 1955.

R. V. J.


STONE AGE
AND
LATER PRE-HISTORIC CULTURES
OF
INDIA
BURZHOM
KUSALGARH
CHAUNTRA
SIWALIK
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RUPAR
HARAPPA
SURATGARH
HANUMANGARH
HASTINAPUR
R. INDUS
BAHAWALPUR
SUKKUR
MOHENJODARO
ROHRI
BIKANER
R. GANGES
KARACHI
BUNDI
R. CHAMBAL
HAMIRPUR
CHITOR
BANDA
REWA
MIRZAPUR
MANDASOR
PEDHAMLI
DEORI
KOTA
RANCHI
LANGHNAJ
VASAD
MAHESHWAR
CHOLI
MANDALESHWAR
JABBALPUR
RANGPUR
PACHMARHI
HOSHANGABAD
RAJPIPLA
NAVDATOLI
KULIANA
SAMBALPUR
TALCHER
CALCUTTA
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SISUPALGARH
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INTRODUCTION

In the year 1949, Dr. F. E. Zeuner, Professor of Environmental Archaeology at London University, along with certain other archaeologists, paid a hurried visit to the Malaprabha river and examined the rich palaeolithic sites of Khyad and Menasgi (Megur Asoti). It was nearly seventy years after the pioneer work of Robert Bruce Foote that the problem of the pre-history of this region was again brought into prominence. My lucky participation in this field trip introduced me to this new line of research where one can utilize one's geological knowledge in archaeological investigations, and inspired me to undertake a detailed pre-historic and geological survey of the Malaprabha basin.

Dr. Zeuner, before coming to Karnatak, had spent a few weeks in Gujarat with a view to surveying the pre-historic (stone-age) sites of that region. On the basis of the data collected there as well as on the Godavari and on a part of the Narbada, he published a monograph containing a provisional account of the geochronology of Gujarat. Now, since both Gujarat and the Bombay Karnatak are parts of Western India, it seemed quite likely that these regions might have witnessed the same climatic, and possibly similar cultural, cycles in the past. The work that I have carried out on the Malaprabha river is, therefore, on the lines of Dr. Zeuner's work in Gujarat.

The survey of the Malaprabha river was substantiated by actual field work in other regions as well. I observed the Upper Godavari valley near Nasik, where Dr. Sankalia recently unearthed palaeolithic tools; a part of the Mahi river in the Baroda State was surveyed along with Dr. Subba Rao, of the Baroda University; and the Narbada river survey near Maheshwar was carried out with Drs. Sankalia and Subba Rao during the Joint Universities' Expedition on this river. I also visited the palaeolithic sites of Drs. De Terra and Paterson on the same river at Hoshangabad. In Karnatak, some portions of the Krishna near Saptasagar, and the Ghataprabha near Gokak and between Bagalkot and Herkal, were also examined by me.

The results of this intensive survey are presented here. It includes the geological, geomorphic, and pre-historic observations of the Bombay Karnatak region. The work may be regarded as the first systematic and comprehensive account of the culture of Early Man of Karnatak and his environment.

The area covering nearly 100 miles out of the total 200 miles of the Malaprabha course was surveyed with a view to finding as many palaeolithic sites as possible and studying the position of the implementiferous gravel-bed relative to other river deposits which are exposed in cliff-sections at several places on the river.

Twenty sites were located and over nine hundred tool specimens were collected from all these sites. At more than half a dozen places the artefacts were recovered "in situ" from the undisturbed gravel-conglomerate. Samples of river deposits were also studied by me mechanically by the International Method and their heavy residues were examined under the petrological microscope. This was done as an attempt to find out the possible climatic conditions that were prevailing at the time of their deposition.

The work is thus twofold: firstly, study of environment by the application of geological methods; and, secondly, identification and classification (typology) of the palaeolithic tools including a comparison of the Karnatak artefacts with similar finds from other regions of India and corresponding foreign types.

Previous Work in India

After FOOTE's[1] pioneer survey of the Southern Maratha Country about seventy years back, the work of Drs. TERRA and PATERSON[2] in South Western Kashmir and the Punjab laid the foundations of the systematic pre-historic investigations in India. This was followed, almost on parallel lines, by KRISHNASWAMI,[3] near Madras. The pre-history of Gujarat was later studied by SANKALIA,[4] who surveyed the valleys of the Sabarmati, Mahi and Orsang rivers. SEN and BOSE[5] investigated the palaeolithic sites near Mayurbhanj, in 1948. Recently, the pre-history of Bellary District was studied by SUBBA RAO,[6] while the work on the Godavari near Nasik was carried out by SANKALIA.[7] ZEUNER,[8] who undertook a rapid survey of various pre-historic

1. FOOTE, *Geoolgical Features of the South Maratha Country, MGSI,* Vol. XII, Part I, p. 242; also, *The Foote Collection of Indian Prehistoric and Protohistoric Antiquities, IPPA,* Madras, 1916.

2. DE TERRA & PATERSON, *Studies on the Ice Age in India and Associated Human Cultures,* 1939.

3. KRISHNASWAMI, *Changes of Prehistoric Man near Madras,* 1938.

4. SANKALIA, *Investigations into Prehistoric Archaeology of Gujarat,* 1946.

5. BOSE & SEN, *Excavations in Mayurbhanj,* 1948.

6. SUBBA RAO, *Prehistoric and Early Historic Bellary,* 1949.

7. SANKALIA, *The Palaeolithic Industry of the Godavari River,* 1952.

8. ZEUNER, *Stone Age and Pleistocene Chronology in Gujarat,* 1950; also, *Prehistory in India,* 1951.

sites in India, has published some articles relating to the geochronological problems of India. Besides these major works, several new places of pre-historic interest have been brought to light, but their systematic study has not been undertaken so far.

All the regions mentioned above have yielded a vast amount of pre-historic material dating from the Early Stone Age to almost the beginning of the Christian Era, which has firmly established the antiquity of the Indian sub-continent.

The question now is not of finding new sites, but of picking up details of the past ages of India of which we unfortunately know so little. We have very meagre knowledge of the changes that took place in our environmental conditions since the Pleistocene times. Another unsolved problem of the palaeolithic period is "whether India had any share in the origination of any of these earlier (Pre-Soan and Hand-axe) cultures, or whether she merely received these cultures from the South-East or Africa and accommodated them on her soil."[9] Much more work, and that too on modern lines would, therefore, be required to answer these and similar questions.

9. SANKALIA, *Archaeology and Indian Universities*, p. 2, 1952.

PART I

SECTION I

GENERAL

Physical Features

The region treated in this thesis lies approximately between the longitudes 74° 15′ E. and 76° 4′ E, and the latitudes 15° 30′ N and 16° 12′ N. It is a part of the Eastern Karnatak Plateau, adjoining the Western or Sahyadri Ghats, and represents the southern extremity of the Bombay State, popularly known as the Bombay Karnatak. It includes the Belgaum, Bijapur, Dharwar and Karwar Districts, the southern administrative divisions of the Bombay State.

The Krishna river and its tributaries constitute the drainage of this area. The region is predominantly underlain by the gneissic rocks in the south, while its western edge is characterized by the rocks of the Dharwar series, and by lava outflows on the north. The central parts are crossed by the outcrops of the Bhima and Kaladgi formations.

This varied geological foundation of the Bombay Karnatak has greatly influenced its morphological aspects. An undulating "black-plain" of the eastern plateau interspersed with the residual hills of Badami, Saundatti, Nargund, Navalgund, Gokak, etc., broad and fertile valleys of the Krishna river and its tributaries, and clusters of low hills on its western margin are notable geomorphic features of this region.

All the palaeolithic sites and other places described in this work can be found in the Survey of India Topo-sheets (one inch : one mile).[1]

Geology

The geology[2] of the Malaprabha basin is comparatively simple, as it involves a few rock formations that differ in geologic age. It may be summarized as follows :—

Pleistocene & Recent	Black or red soils, calcareous tufa, brown sands, gravel-implementiferous.
Lower Kaladgis (Cuddapah system)	Siliceous limestones, shales, sand-stones, quartzites, conglomerates.
Archaeans including Dharwars	Schists, granite-gneiss, quartzites, etc.

1. [47 P (16), 48 I (6, 10, 13, 14), 48 M (1, 5, 9, 13), 56 D (4).] See also Map, Fig. 5.

2. See the geological map of the Malaprabha basin, Fig. 2.

(Besides these chief formations, there are several minor intrusions, like dolerite dykes, pegmatites, etc.).

ARCHAEANS INCLUDING DHARWARS

This is the oldest and the most extensive rock formation of the Malaprabha basin, which occurs in the upper course of the river and to the south of it. Starting from west of the basin and following the course of the river eastward, we can group the rocks observed as under :—

1. Castle-Rock Band :
   - (i) Sericite-quartzites, schistose sericite-quartzites.
   - (ii) Muscovite, chlorite, quartz, schists.
   - (iii) Hornblende, biotite, garnet, gneisses.

   (All these outcrop near Khanapur and to the west of it.)
2. Khanapur Granite Gneiss.
3. Part of the main Dharwar Band : Shales, argillites, phyllites, chlorite-schists, ferruginous quartzites, calc-schists, etc.
4. Saundatti granite-gneiss and a part of the Gadag Band.

Out of these, the granite-gneiss—Khanapur and Saundatti types—has considerable aerial extent, particularly in the region under description. The schistose varieties belong to the Upper Dharwars which are the metamorphic derivatives (of low grade metamorphism) of the ancient sediments. They are exposed in the form of irregular bands running approximately north-west and south-east, with a high angle of dip (60°-80°) towards east or north-east.

The exposures are very few, because in the west they are concealed by a thick vegetation, and to the south of the river covered by a thick mantle of the black cotton soil of the Gadag plain.[3] It is mostly in the beds of the river and its tributaries that these rocks are visible.

These rocks exhibit a varied scenery. Granite-gneiss near Khanapur, being massive, shows hill features composed of more or less rounded boulders, with examples of "tors" here and there. The schistose areas "differ from the granitoid areas by the much greater smoothness of their surface; for, even when they form hills, they are in most cases gently rounded in form, and rarely show very rocky surfaces."[4] Granite gneiss and other members of the Gadag-band, which occupy the country to the east of Saundatti, are covered with a variable thickness of black cotton soil, and almost a plain topography is developed on them. A large number of minor intrusions, like basic dykes, granite dykes, pegmatites, aplites and quartz-veins, etc., are observed in these rocks. They are often found crossing the river bed.

3. *RGSI*, XXXIV, ii, pp. 101.
4. FOOTE, *Geology of South Mahratta Country, MGSI*, XII, Part I, p. 48.

Lower Kaladgis

The Upper Cuddapah system of Peninsular India is represented in this region by the Kaladgi series which is divisible into two groups—Lower and Upper. Out of these, only the rocks belonging to the former group are found in the Malaprabha basin. They are:—

(1) Sandstones, quartzites and conglomerates.
(2) Shales — containing a few bands of sandstones and siliceous limestones.
(3) Siliceous limestones with a few intercalations of ferruginous sandstones.

The whole system rests unconformably on the folded and eroded older formations. The rocks are monotonously uniform in character and show little variety except in shades of colour. The basal quartzites and, to some extent, conglomerates cover the greater portion, the shales and limestones being very subordinate in superficial extent. Over most of the area their dips are low —less than 12°,—while at some places the rocks are almost horizontal. The dip direction is north-east or north with a prevalent strike WNW-ESE. Before Saundatti, these rocks mark the northern bank of the Malaprabha, but a little above that town the river enters the Kaladgi basin, cutting a gorge through the quartzite hill and then for a considerable distance flowing over these formations. Practically all the raw material of the palaeolithic tools is obtained from the rocks of this system. A few isolated hills are also found to the south of the river, namely, the Nargund, Chik Nargund and Navalgund hills.

The harder arenaceous (quartzites, etc.) members of the lower Kaladgis form rugged hills and steep escarpment features, while the country occupied by shales (viz., near Manoli and to the east of it) and limestones is a low, gently undulating plain.[5] The asymmetrical valley-forms of the Malaprabha river are due to the differential erosion of these and the older rocks. They have also influenced the gradient of the river.[6]

Pleistocene and Recent Deposits

The deposition of the implement-bearing gravel on the pre-pleistocene landform marks a comparatively recent activity in this region. A detailed account of these deposits is given in a separate section. They provide very important clues to the interpretation of the subsequent geologic history of the Malaprabha basin. These deposits include:—

Surface soils: Black cotton soil, red soils, and recent river alluvium.
Calcareous tufa (near Badami).
Ossiferous deposits of the Ghataprabha river.
Brown sandy deposit of the Malaprabha river.
Basement gravel-conglomerate (implementiferous).

5. Foote, *op. cit.*, p. 76.
6. See the longitudinal profile of the Malaprabha river. Fig. 3.

Drainage : Past and Present

The entire Karnatak plateau, to which the Malaprabha river basin belongs, has undergone processes of peneplanation several times in the geologic past. While nothing can be said about the cycles of erosion prior to the formation of the Kaladgis, the general drainage pattern of that period, judging from the structure of the Dharwars might have followed the north-west south-east (strike-streams) and eastern or north-eastern (dip-streams) directions. The sediments derived from the action of these ancient streams were deposited in an inland basin which further produced the Kaladgis. The rocks of this system have east-west trends and varying dip directions—north or north-east, south or south-east, and the streams formed on this land might have taken corresponding directions. From that period, another set of cyclic processes of denudation started on the combined landforms of the Kaladgis and older rocks. In a later period, eruptions of the Deccan Trap lavas, the faulting of the land in the Arabian Sea and the formation of the Western Ghats must have greatly influenced the ancient drainage of this land.[7] The changes introduced thereafter were comparatively minor and mostly due to the fluctuations of climate (pluvial or drier, etc.).

The presence of deep gorges in the course of the Malaprabha river and its meandering pattern perhaps indicate a superimposed drainage.[8] The Deccan Trap lavas possibly covered, formerly, a considerable portion of this basin, and the drainage formed on them eroded the trap cover and became superimposed on the lower Kaladgi formations. But, since the occupation of this region by the Deccan trap flows has not been definitely established, this would be only a tentative explanation. Another possibility is that the Deccan Trap did not actually cover the area under description, but the dip or diagonal streams formed on the gently inclined Kaladgis underwent repeated captures due to headward erosion of their valleys, the uniclinal shifting or migration of the homoclinal ridges joined the strike streams, and thus the present zig-zag pattern was formed.[9] A valley between the Parasgarh and Saundatti hills, which is now occupied by a small stream Ballari-Jaul Halla (flowing eastward) perhaps shows the older course of the river prior to its

7. Vrendendurg, "Pleistocene movements and their effects on rivers of Peninsular India." *RGSI*, XXXIII, Pt. 1, pp. 33-46.

8. Shirol, *Geology of the Central and Southern parts of the Belgaum District*, p. 196, 1950. (Thesis for the M.Sc.)

9. Cotton, *Geomorphology*, p. 89, 1945.

entrance through the Naul-Tirth or Manoli gorge.[10] Before the deposition of the pleistocene (palaeolith bearing) gravels, the river seems to have achieved its present form.

The hill-tops and the boulders which had fallen at the foot of the escarpments provided the necessary shelters for the palaeolithic settlers of this basin. The drier phase of the climate that followed, later compelled the inhabitants to abandon the valley. The streams of that period dwindled down in shape and activity, and a large quantity of sand was discharged by them, burying the palaeolithic tools along with the gravel and talus deposits.

(It is interesting to note that all the major palaeolithic sites found in this basin are along the foot of steep escarpment slopes of quartzite ridges. The sandy deposit was brought by the small streams which come from the north of the following places: Mulangi, Birnur, Hebbali and near Cholachgud).[11]

The next climatic change from drier to humid rejuvenated the erosive action of the river, whereby it deepened its channel by cutting through previously deposited sand and gravel. The flood-plain and its alluvium (black soil, modern soils) are now being formed during the same activity of the river.

The Malaprabha River

The Malaprabha river has its source among the eastern Sahyadri spurs, about eight miles west of Jamboti in the Khanapur Taluka (Belgaum District). Its name is the Prakrit form either of the Sanskrit "Malaprabhā"—mud-shining, or more probably of "Malaparvā"—full of mud. "Malapāri" is the Prakrit form of Mala-Apahāri (mud-robbing).[12]

> There is an interesting legend about its origin. It is said that "in the village of Kunkumbi, on the eastern brow of the Sahyadris, lived a man who was happy in being the husband of a beautiful and virtuous woman. In spite of his wife's goodness, jealousy seized his soul, and he gave his wife neither rest nor peace. At length, driven to despair, she sacrificed to the gods and, putting up a prayer to Basava, the patron of Lingayats, threw herself into a mountain tarn. No sooner

10. See also *Bijapur District Gazetteer,* p. 11, 1884.
"To the east of the Gajendragad hills an open level tract about eighteen miles long by about twelve broad, is marked by a slight cross ridge which has the appearance of having formerly been the south bank either of the Malaprabha or of some other lost stream."

11. See Map, Fig. 5.

12. Rev. G. Kies' "Southern Maratha Country" 14, quoted in the *Bijapur District Gazetteer,* p. 10.

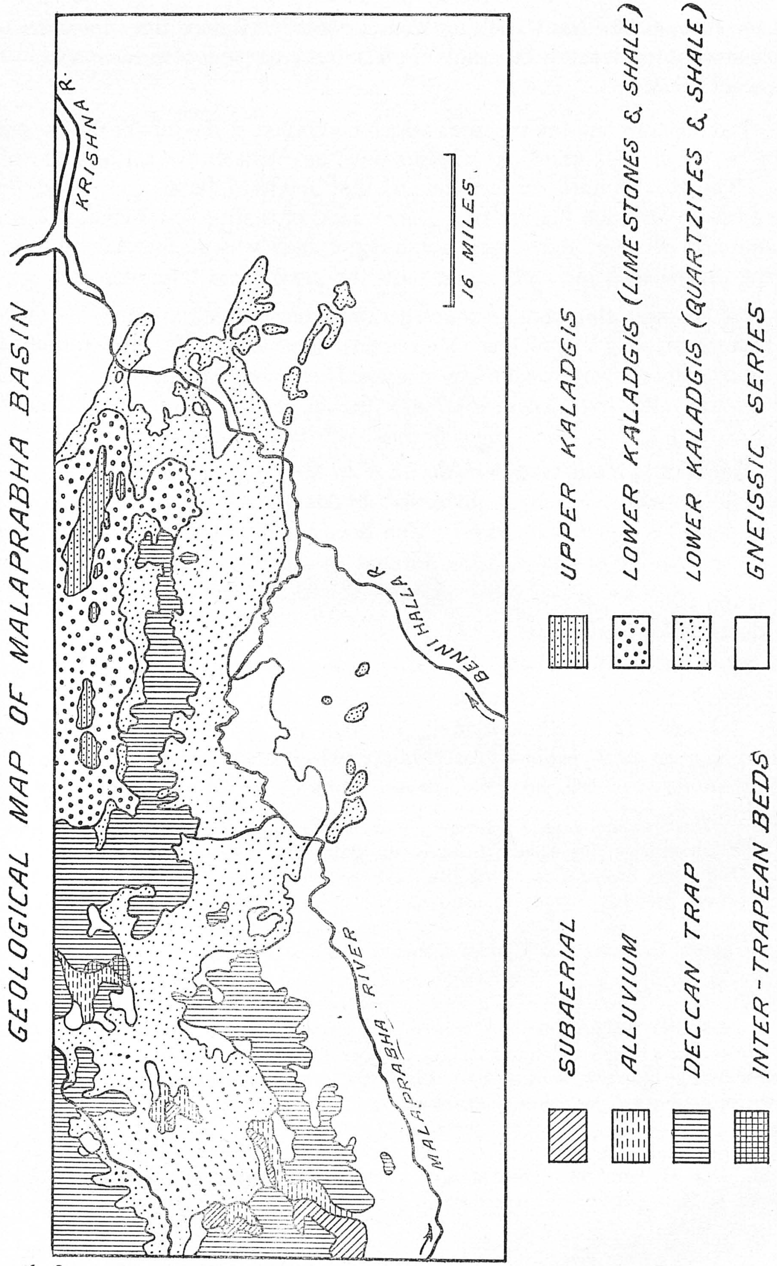

GEOLOGICAL MAP OF MALAPRABHA BASIN
KRISHNA R.
16 MILES
BENNI HALLA R
MALAPRABHA RIVER
SUBAERIAL
ALLUVIUM
DECCAN TRAP
INTER-TRAPEAN BEDS
UPPER KALADGIS
LOWER KALADGIS (LIMESTONES & SHALE)
LOWER KALADGIS (QUARTZITES & SHALE)
GNEISSIC SERIES

Fig. 2.

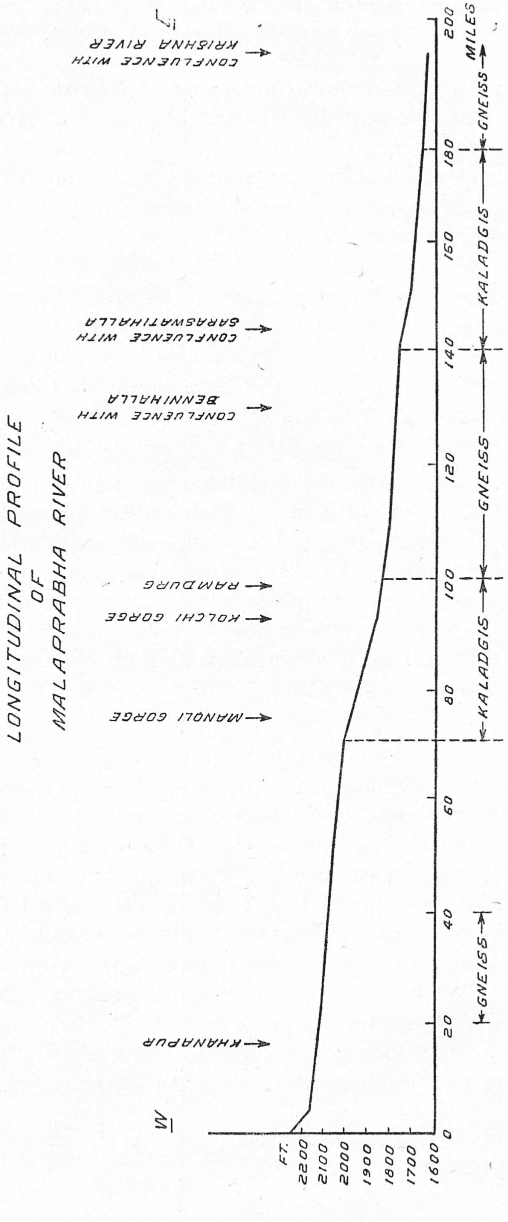

LONGITUDINAL PROFILE OF MALAPRABHA RIVER
W
E
CONFLUENCE WITH KRISHNA RIVER
CONFLUENCE WITH SARASWATIHALLA
CONFLUENCE WITH BENNIHALLA
RAMDURG
KOLCHI GORGE
MANOLI GORGE
KHANAPUR
FT.
2200
2100
2000
1900
1800
1700
1600
0
20
40
60
80
100
120
140
160
180
200
MILES
GNEISS
KALADGIS
GNEISS
KALADGIS
GNEISS

Fig. 3.

did the pool receive this sacrifice, than its waters began to rise, and flowing over this bank, formed a river which was called Malaprabhā or Malāpahāri, the cleanser from sin."[13]

The Malaprabha is a major tributary of the Krishna river, which, together with the other stream, the Ghataprabha, constitutes the drainage of the Bombay Karnatak region. The total length of the river, from its source to its confluence with the Krishna, is nearly two hundred miles. Within this distance, besides possessing a general meandering pattern, it has changed its direction several times, often sharply. Thus, from its source it flows, first, straight to the east as far as Jamboti and then, abruptly turning south for four or five miles, takes a south-eastern trend. Thereafter, beyond Khanapur, it flows north-east; then, with a slight turn towards the east, it enters the Manoli gorge; further on, it resumes its north-eastern course. After Ramdurg, it first runs south-east and then eastward, parallel to the long quartzite ridge. South of Badami, its direction changes to north and then to north-east, but, further, remains the same till its confluence with the Krishna.

A somewhat similar feature is exhibited by the Ghataprabha, which flows almost parallel to and north of the Malaprabha river. In its course, the river crosses rock formations of different ages and, structurally and lithologically, of varied nature. First, it flows over old crystalline rocks, then over lower Kaladgis consisting of sandstones and quartzites; again, over the gneisses and Kaladgis in succession and finally over metamorphic rocks. (See geological map). This passing and repassing through different rock formations has greatly influenced the pattern of the river and the structure of its basin.

The valley profiles vary greatly from place to place. In its upper course near Khanapur and Sampagaon, the river flows between high steep banks; then, when it traverses the Kaladgi formations, it passes through deep gorges as at Manoli, Ramdurg, Ramdhal, etc. Out of these, the Manoli gorge (Naul Tirth) is the most magnificent. (There are two interesting stories about the formation of this gorge.)[14] It is nearly one and a half miles long and about 300 feet deep, with the breadth rarely more than 50 yards. The upper or south-western half is so narrow that, even in moderate floods, not an inch of margin is left between the water and the vertical walls on either side.[15] During heavy floods the water rises 30 to 40 ft. in the gorge, and rushes with mighty force, forming pot-holes of great size and depth, which at every new moon in the fair season, when the water is low, are largely

13. *Belgaum District Gazetteer*, p. 12, 1884.
14. See *Belgaum Gazetteer*, p. 12-13.
15. Ibid, p. 18.

resorted to by Hindu devotees. In its lower or northern half, the gorge widens considerably, and the sides decrease in height till the quartzite beds die out in a level flat which stretches for some distance to north-east. When it runs parallel to the Badami ridge through the Dharwar District, the bed of the river, which is muddy and sandy, is 350 ft. wide and its banks are sloping and earthy and about 12 ft. high. The valley-form in this part is asymmetrical, and "uniclinal shifting" towards the northern escarpment is common.

The river witnesses seasonal floods, and during the rainy season its water rises all too suddenly. The highest recorded flood level is 1763·66 ft., which with a low water level of 1742·88 ft. gives the flood height of twenty-one feet. Normally the river is tame, but during the rainy season it swells enormously and its water penetrates sometimes over half a mile inland from the banks. Soil erosion and cliff cutting takes place under such conditions, and it is much more rapid at the junctions of its tributaries. For instance, Jaul Halla, a very shallow stream, acquires great energy in floods and cuts its banks with such speed that the villages situated on its bank remain in constant danger. The river behaves similarly on its left bank, near Alur, Talakwad, Bennur, etc. In fact all the villages between Ramdurg and Hole-Alur experience this rasping action of the river.

Several small streams enter the river from both north and south; but, except for three or four, all are insignificant, as most of the time they are dry. The beds of all the streams without exception are shallow and filled with sand, the water often being muddy and brackish. From the prehistoric point of view,[16] the Benni-Halla, Hire-Halla, Sasive-Halla (the streams which drain the right bank of the river) and the Hire-Halla (near Manoli) deserve special mention, as some of the richest and most important palaeolithic sites are located on them. The Benni-Halla,[17] the longest and the biggest tributary of this river, originates about 20 miles south of Hubli in the Dharwar District and flows north. After traversing about ninety miles of the Dharwar plain consisting of black soil, it joins the river 3 to 4 miles west of Hole-Alur, a station on the Southern Railway. Megur-Asoti (or Menasgi), a very rich palaeolithic site which yielded hundreds of implements, lies in its bed three to four miles upstream from its confluence with the river.

16. See map and the list of palaeolithic sites, Fig. 5.

17. Benni means 'butter' and Halla means 'stream' in Kannada. The mud in the stream is very soft, like butter, hence the name.

A study of the long-profile[18] of this river brings forth the following characteristics :—

Within a horizontal distance of less than 200 river miles, the land decreases in height from 2300 ft. to 1600 ft., the average fall being 3·5 ft. per mile. But, what is more interesting, this value is not constant and so does not represent a true characteristic of the river. This is fairly clear from the following table :—

River Miles	Gradient* (ft. per mile)		
0- 4′8	10′4	}	Youthful
4′8- 9′1	11′6		
9′1- 20′7	4′31	}	Mature
20′7- 51′2	1′64		
51′2- 71′5	2′64		
71′5- 77′5	8′33	—	Youthful : Manoli Gorge
77′5- 86′3	5′7	—	Mature
86′3- 93′6	6′8	—	Youthful : Torgal-Ramdurg Gorge
93′6-108′4	3′4	}	Mature
108′4-141′0	1′53		
141′0-151′3	5′0	—	Youthful : Gorge near Nagarhal.
151′3-175′4	2′0	}	Mature
175′4-194′2	2′65		

(* Gradient calculated at an interval of 50 ft. contour from the Survey sheets)

After Söhnge and Lowe, the river may be said to be representing "youthful" and "mature" aspects at certain intervals.[19] In general, the gradient has higher values when the river flows over the lower Kaladgis and lower values when it traverses the old crystalline rocks or runs parallel to the boundary between these formations. A number of rock barriers, provided by the quartzite ridges of the lower Kaladgis, almost athwart the river, have separated the Malaprabha basin into several compartments, in each of which the flood-plain is graded with respect to the next barrier below it.

18. See Fig. 3.

19. Sohnge and Lowe, *The Geology and Archaeology of the Vaal River Basin*, p. 11, 1937.

"The terms 'mature' and 'youthful' refer to the aspects of the portion of the river and not to their age in terms of a geographical cycle."

In each of these flood-plains the local base level of erosion is reached according to the hard or soft character of the rock formations on which the river lies. The river energy, therefore, is expended, as is evidenced from the maps, in vibrating across its flood plain. At the barrier there is what DAVIS *calls* "a fixed node", above and below which the river valley is broad, narrowing again as another node approaches. The aggradation of the river deposits is observed before the entrance of the river into the first barrier (near the Manoli gorge) and then at the terminal end of the second barrier beyond Ramdurg (Mulangi gravels).[20]

Besides the ridges of the Kaladgi formation which have influenced the long-profile, there are several subsidiary knick points[21] in the path of the river which also check its normal flow. For instance, pegmatite, granite, dykes or outcrops of haematite-schist cross the river at Hittangi, Katral, Maneri, Megur, Khyad, etc. Practically at each of these obstructions, accumulation of gravel containing some implements is noticed.

Climate, Vegetation and Animal Life

The climate of the Malaprabha basin is typically monsoonal, with all the characteristics that are commonly recognized in Western India.[22] The relief has greatly influenced the distribution of pressure, temperature and rainfall over this part of the Bombay Karnatak, and, to some extent, the varied rock formations and the vegetation cover have further modified it.

In general, the summer season begins in March and lasts well up to the middle of May, when the day temperatures everywhere are high. To the south of Badami, the heat is sometimes exceptionally trying near the sandstone cliffs, which in the afternoon and evening, radiate oppressively hot air.[23] The extreme dryness and lack of sufficient vegetation cover, particularly in the eastern part of the basin, keep the soil particles loose, so that the prevailing strong winds often raise a large quantity of sand and thus alter the texture of the surface soils. The increase in humidity by the end of this season makes the climate almost unbearable.

The condition improves when the south-west monsoons set in, ushering in the beginning of the rainy season. During the next four months till September, this region gets its major share of precipitation. "The season is

20. Ibid., p. 40.

21. A similar phenomenon is observed on the Sabarmati (Gujarat), and Godavari (Maharashtra) rivers. See ZEUNER, *Stone Age and Pleistocene Chronology in Gujarat*, pp. 14, 37. 1950.

22. DESHPANDE, *Western India*, p. 46, 1948.

23. *Bijapur District Gazetteer*, p. 12.

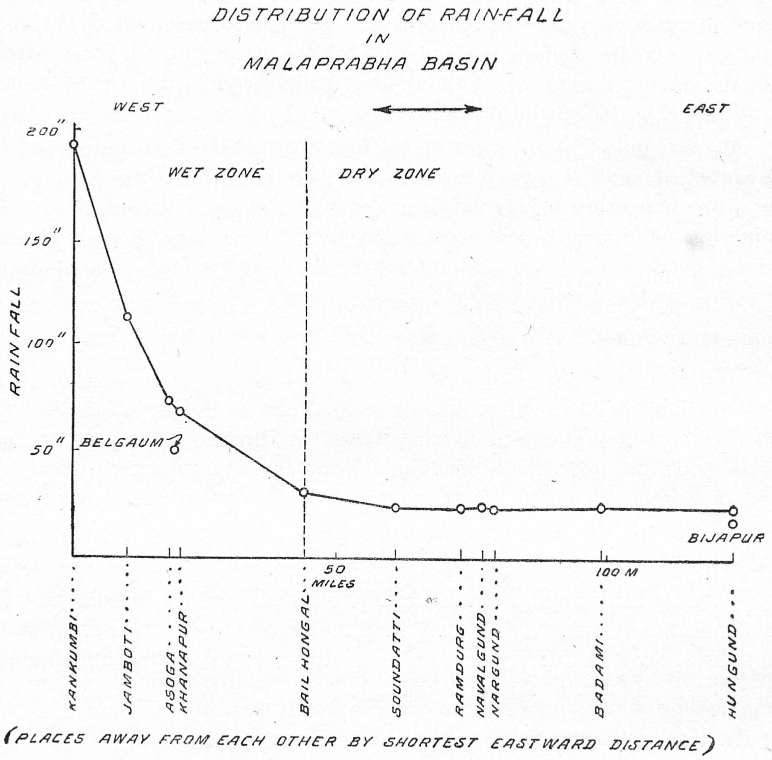

DISTRIBUTION OF RAIN-FALL
IN
MALAPRABHA BASIN
WEST
EAST
WET ZONE
DRY ZONE
200"
150"
100"
50"
RAIN FALL
BELGAUM
BIJAPUR
50
MILES
100 M
KANKUMBI
JAMBOTI
ASOGA
KHANAPUR
BAILHONGAL
SOUNDATTI
RAMDURG
NAVALGUND
NARGUND
BADAMI
HUNGUND
(PLACES AWAY FROM EACH OTHER BY SHORTEST EASTWARD DISTANCE)

Fig. 4.

marked by a succession of cyclonic storms ('bursts') accompanied by 'breaks' of fine weather."[24] The distribution of rainfall over the basin from west to east is remarkable. Its western end, a hilly tract close to the Western Ghats, receives a heavy precipitation, but towards east it decreases so drastically that Bail-Hongal, a place only about twenty-seven miles north-east of Khanapur, gets less than half the amount (i.e., 28 inches; Khanapur 66 inches),[25] while the extreme eastern parts record still less (about 20 inches) rainfall per annum. This variation in the distribution of rainfall may be attributed to the fact that the entire Malaprabha basin lies in the rain-shadow zone of the Sahyadri hills. The north-east monsoons in winter do not add much to the average annual rainfall amount of this region. From November to February, low temperature prevails all over the Karnatak plateau with an intervening hot month. (October heat is a marked feature of this land.)

The rains in Western India, in general, are of a very variable nature. Owing to their "prolonged breaks, delayed beginning, abrupt and premature ending and variability from year to year,"[26] the eastern margin of this basin remains in constant danger of famine.[27]

At almost all times of the year, the entire region, particularly the eastern tract, is exposed to a strong blighting wind. From November to February, it blows from the east and is very dry. In March and April, the wind is generally from the north-east, and in May from the south or south-west.

On the basis of distribution of yearly rainfall and temperature, the region can be conveniently divided into two zones, namely, the western "Wet-Zone" and the eastern "Dry-Zone", with the boundary between them passing somewhere near Bail-Hongal. The distribution of vegetation and the landscape types conform to this division.

Vegetation

"In all the Tropical monsoonal countries it is the rainfall, both in its amount and regime, that shapes the vegetation pattern."[28] The wet-zone, with a rainfall over 50 inches, has a typical monsoonal forest having a sea-

24. Deshpande, *op. cit.*, p. 49.

25. Rainfall data supplied by the Irrigation Department of the P.W.D., Bombay State, and the Mamlatdar Offices of Ramdrug and Hungund talukas. See the rainfall map, Fig. 4.

26. Deshpande, *op. cit.*, p. 58.

27. See *Statistical Atlas of the Bombay State,* Fig. 12, 1950.

28. Deshpande, *op. cit*,. p. 66.

sonal rhythm and often displaying an intermixture of deciduous and evergreen trees on its eastern edge. The transition to dry vegetation is effected through the dry teak forests. The drier parts, where rainfall is usually between 20 and 30 inches, produce a typical thorn forest formation.[29]

The vegetation is scanty, mostly composed of shrubby drought-resisting species which can thrive even in barren soils like those formed on the sedimentary rocks of the Kaladgis.[30] A common development of spines and thorns is noticeable in this tract. Babul (*Acacia arabica*) and Nim (*Melia azadirachta*) are the commonest trees, which usually grow on the black and red soils respectively.[31] Other species include *Cassia auriculata, Cleome, Capparie, Cassia Woodfordia, Vicoa, Echinops, Celosia* and several species of *Acacias*. The wild date palm is found in depressions.

Krishnaswamy gives the following account of the Ramdurg forests: "The growth type is 'dry-deciduous'. Pronouncedly xerophytic species predominate in growth. The forest is patchy and open on hills and ridges. In sheltered valleys trees generally grow close together to form a coherent forest canopy. Tugli, Nim, Dindal and Babul predominate, but the scrubs are more marked by some species of succulent Euphorbias."[32]

The occurrence of betel-gardens south of Badami and the silviculture operations in the adjoining forest area may also be noted here.

A variety of crops, ranging from rice, the representative of subsistence agriculture, to commercial crops like tobacco and cotton, are grown in the western Zone of the Malaprabha basin. Jowar (*Holcus sorghum*), rice, wheat, bajri (*Holcus spicatus*), ragi (*Cynosurus corocanus*), pulses, oilseeds, and tobacco are the chief agricultural products of this area.

While the plains are marked by the black soil that dominates the land in Karnatak, red appears to be the foundation colour of the hills. The region underlain by the quartzites is marked by a scrubby vegetation, the poverty of which is still further increased by the scanty rainfall. To the south and east of this basin lies the rich black soil plain, well-known for its cotton production.

Animals

In the Dry-Zone, the hog is a very common wild animal. The only large game are a few leopards, which find shelter in almost all the ranges

29. See *Statistical Atlas*, Fig. 16 and p. 7, (vegetation zones of Western India).

30. Agharkar, "Symposium on Arid and Semi-Arid Tracts of Peninsular India," *National Inst. of Sciences in India*, p. 23, 1952.

31. *Bijapur District Gazetteer*, p. 64.

32. Krishnaswamy, *Indian Forester*, Jan. 1943.

south of the Krishna. The wolf and the hyena are generally distributed. The jackal is found everywhere, and the fox appears in the open undulating plains. Leopards are generally distributed in this region, but tigers are met with only in the south and south-west. Among the domestic animals, goats, horses, buffaloes, cows, etc., are the common types. The river abounds in fish.

Bombay Karnatak: Its History, People and Culture[33]

The Malaprabha basin belongs to the Bombay Karnatak, the southernmost division (linguistic) of the Bombay State, which itself is a part of western India. The Bombay Karnatak is actually the northern extension of the Greater Karnatak, which besides the four Kanarese districts—Belgaum, Bijapur, Dharwar and Karwar—of the Bombay State, includes the whole of the Mysore State and some districts of the Madras State and Hyderabad where the Kannada language is spoken. It occupies a very definite place in the history of ancient India, both politically and culturally. The earliest references to it, as Karnāta or Karnātaka, are met with in the great epic Mahābhārata. But whether it existed as a separate entity in the pre-epic period is still a moot point.[34] Nevertheless, considering the large number of antiquities[35] of all the three great ages—Stone, Copper-Bronze, and Iron—obtained from Karnatak, this part of India appears to have been inhabited from the earliest period of human history.

33. The information is drawn from the following works:
   (i) MUGALI, R.S., *The Heritage of Karnataka*, 1946.
   (ii) DESHPANDE, C. D., *Western India*, 1948.
   (iii) FLEET, *The Dynasties of the Kanarese Districts of Bombay Presidency*, 1882.
   (iv) *District Gazetteers of Belgaum, Bijapur, Dharwar and Karwar.*
   (v) *United Karnatak*: A Hand-book of the Karnatak Unification Committee, 1928.

34. "On the strength of other evidence, however, it is possible to show that Karnātaka, as known to the complete Mahābhārata, probably belongs to the pre-Christian era; that is, the evolution of Karnataka as a distinct entity will have to be taken as having started before 300 B.C. and to have been complete by 100 B.C., to the best of our knowledge to-day."
MUGALI, *op. cit.*, p. 10.

35. See: (i) FOOTE, *Indian Pre-historic and Protohistoric Antiquities*, pp. 130-34.
   (ii) WHEELER, "Brahmagiri and Chandravalli: Megalithic and other Cultures in Mysore State", *Ancient India*, 1948.
   (iii) PANCHMUKHI, *Progress of Kannada Research in Bombay State*, 1941-1946, 1948. Also the circular issued by him describing various prehistoric sites in Bombay Karnatak.

Its earlier but more definite history dates back to the two Mauryan emperors, Chandragupta and Ashoka. Chandragupta (321-297 B.C.), the founder of the Mauryan empire, is said to have set foot on the Kannada soil as a Jaina devotee, and not as an emperor. From about the third century A.D. up to the thirteenth century A.D. three or four powerful dynasties—the Kadambas, the Western Chalukyas, the Rashtrakutas, the Yadavas and the Hoysalas—successively ruled Karnatak or parts of it. The rule of the Vijayanagar (1336 A.D.) kings acted as a unifying influence over this part, which had already found a common linguistic and cultural bond. But with the rise of the Bahamanis there began a steady disintegration, and the sense of unity was practically lost under the influence of the Nizam and Maratha powers. By the beginning of the seventeenth century, this region became a theatre of war for its neighbours. The eighteenth century, however, witnessed the settlement of Maratha chieftains in strategic areas of the rich plains of the Bombay Karnatak. The influence of the Maharashtra culture under Maratha rule persisted throughout the nineteenth century. In the present century, however, owing to the spread of education and the general awakening in all spheres, there is a growing demand for unification and the creation of a separate Karnatak State.

Like the rest of India, Karnatak is made up of at least three primary elements (1) Pre-Dravidian, (2) Dravidian, and (3) Aryan. The present population, in all its confusing diversity, is a complex and unrecognizable stratum of society. Its culture has grown out of a blending of Dravidian and Aryan strands. Though this culture is the same, in essence, as that of any other state in India, especially of South India, it is distinct in certain features, such as the Kannada language[36] and literature, the arts (sculpture and architecture) and social, religious and philosophical traditions. The region between the rivers Ghataprabha and the Malaprabha can well be described as a belt of cultural conflict. For, to the north of it lies Maharashtra, which in its Aryan tradition, history and religion, stands in contrast to the predominantly Dravidian culture of Karnatak, in its present form as influenced by Jainism, Veershaivism and Vaishnavism.

In spite of the exceptional richness of the Bombay Karnatak in archaeological potentialities, as is revealed in the preliminary surveys, no part of this region has been systmatically explored so far.

36. Bombay Karnatak:

Area in square miles	..	18,874
Population	..	3,469,000
Kannada population	..	2,500,000

DESHPANDE, *Western India*, p. 123.

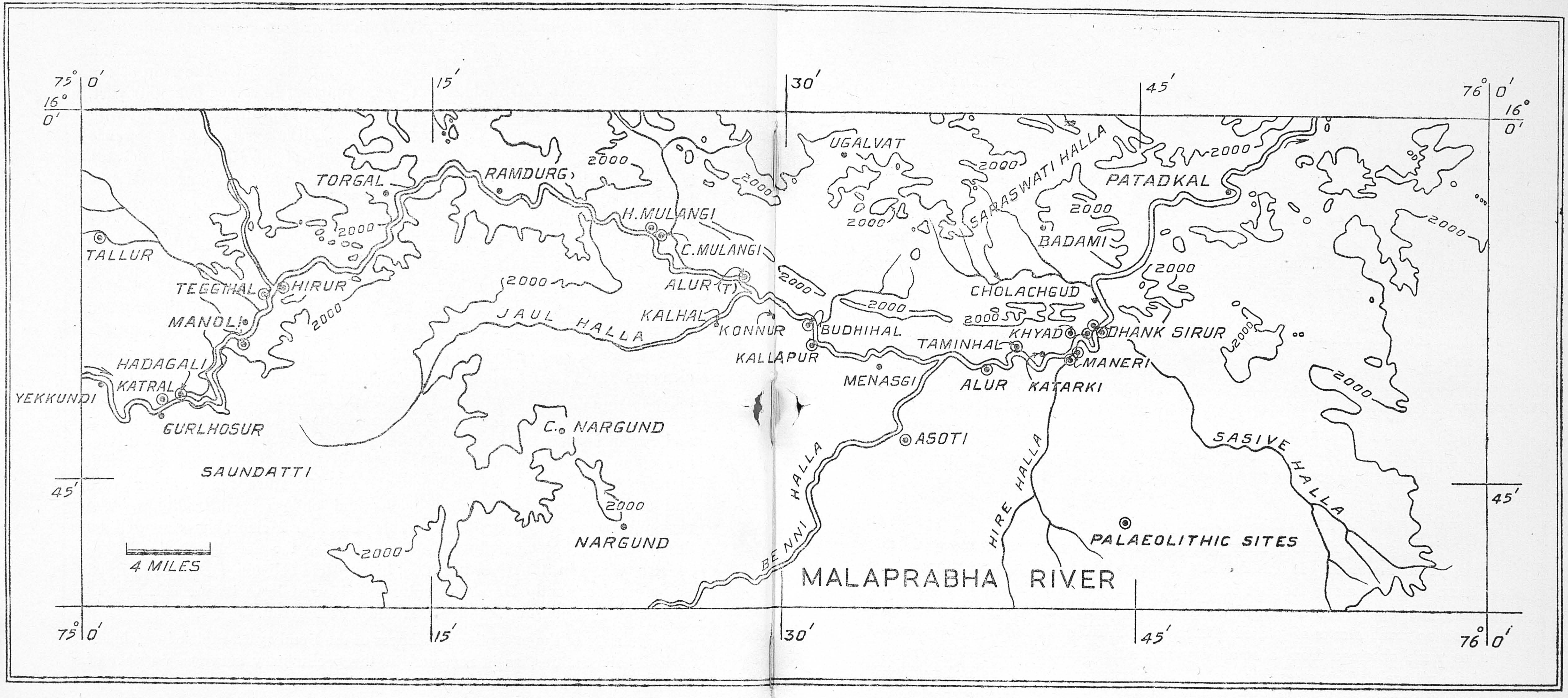


Fig. 5.

MAP SHOWING THE PALAEOLITHIC SITES IN THE MALAPRABHA BASIN.

SECTION II

PALAEOLITHIC SITES

In the following pages, all the sites* are described fully. They are arranged in a sequence from Gurlhosur down-stream the river. The date on which each one was visited is also mentioned in order to mark the season.

1. Katral (12-4-1951)

About two miles downstream from Gurlhosur and beyond Katral, a large quantity of gravel is found in the river-bed. It is very similar to Khyad gravel but poor in the number of implements. Just beyond Katral, in the cliff section exposed on the left bank (northern bank), the gravel is at the bottom and is undisturbed. From the bed of the river, 3 hand-axes, 1 chopper and 2 core-scrapers were collected.

Similar sections were noticed on the river further down, near the village Hadgali and others opposite Vatnal; neither, however, yielded any artefacts.

The bed of the river, from Yekkundi to Vatnal, is strewn with a large amount of well-rounded gravel; but, except in the section where it is superimposed by other deposits (sands), it is difficult to distinguish it from the extensive talus found all along the escarpment, about two to three miles north of these places.

2. Tallur (13-4-1951)

This site is about 8 miles north-west of Manoli, and as many miles away from the river. It was difficult to locate the actual site mentioned by Foote. For, all along the foot of the hill there is an extensive talus deposit. The gravel appears to be not of water-worn pebbles, but formed by thermal action on small blocks of jointed quartzite fallen from the hills. Three hand-axes were obtained from a small dry and silted nullah which flows north of the village. (This stream is one of the tributaries of the Hire Halla which meets the river on its left bank, a mile beyond Manoli.) All the specimens are perfectly rolled. This site is described by Foote as follows:—"Gravel beds of undetermined origin, but probably lacustrine, or fluviatile, were

* For the sites see Fig. 5 and pls. VI-IX.

observed at .... the foot of the Katharigarh hills, near the village Talur, about 8 miles north-west of Manoli .... The gravel-bed consists mainly of Quartzite pebbles, and .... is singularly coarse, no section was seen, and the implements were found on the surface. All were rather water-worn."[1]

3. MANOLI HILL (2-2-1950)

On the northern slope of this hill and towards the end of the gorge (Naul Tirth Gorge), occurs an immense quantity of rock rubble varying in size from small roundish pebbles to huge blocks of quartzite. At one place, a few doubtful specimens of artefacts were collected. There are a number of quarry pits on the top of the hill, in which pisolitic gravel, highly stained by iron-oxide and having dark brown or chocolate colour, is exposed just below a thin soil cover. It, too, yielded some tool-like pieces of quartzite. This hill is an excellent site for the study of the raw material of the tools, which is mainly a fine-grained quartzite with beautiful purple, pink and red colours. Near Manoli, there is an extensive field of megalithic monuments. These primarily consist of underground dolmenic cists, surrounded by a stone circle.

4. TEGGIHAL (1-2-1950)

On either side of this village, two streams—Tallur Halla and Hira Halla—drain into the river. At the confluence of these, a few flakes and two good implements were found.

5. HIRUR (1-2-1950)

This is another village downstream. Between this and the village Jakhabal, 10 to 15 tools were collected.

At a place named Shindogi, a buff-coloured mottled clay was observed, but there was no gravel-bed above it.

6. HIRE MULANGI (21-3-1952)

About 8 miles east of Ramdurg, the implementiferous gravel-bed is exposed for a considerable distance (approximately 1 mile), from Hire-Mulangi almost to another village, Chik-Mulangi, downstream. The cliff on the left bank just below Hire-Mulangi is very steep, having a height of about 10 ft., above the present water-level. The depth of water at this place was

1. FOOTE, *Geology of the South Mahratta Country*, *MGSI*, XII, Part I, p. 242.

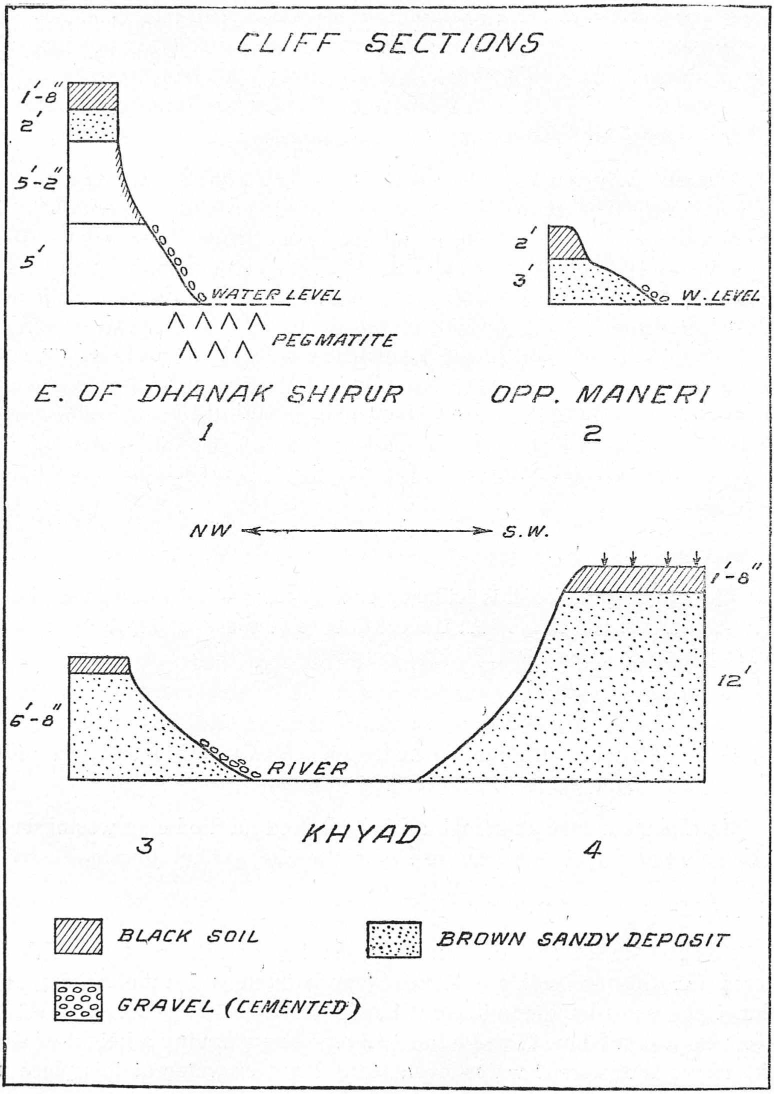

CLIFF SECTIONS
1'-8"
2'
5'-2"
5'
WATER LEVEL
PEGMATITE
E. OF DHANAK SHIRUR
1
2'
3'
W. LEVEL
OPP. MANERI
2
NW
S.W.
1'-8"
12'
6'-8"
RIVER
KHYAD
3
4
BLACK SOIL
BROWN SANDY DEPOSIT
GRAVEL (CEMENTED)

Fig. 6.

over 6 ft., which prevented a detailed examination of the cliff from its bottom. The following observations are, therefore, restricted only to a height of 15 ft. above the water-surface. The gravel is very coarse, containing pebbles varying in diameter from 4 to 8 inches, and all firmly bound together in a calcareous cement. The implements recovered from it are large and stained or weatherd and rolled. All are 'in situ' specimens.

The conglomeratic gravel-bed is about 10 ft. thick, and except for a very insignificant bench at half way, is almost vertically exposed.[2] (This created another difficulty in collecting specimens from the gravel.) Above the gravel, and intimately mixed with it, is a layer of mottled clay (silty) overlain by 6 ft. brownish sand with kankar. The soil near the village is sandy, with a considerable growth of thorny Babul trees (*Accacia arabica*). The thick gravel-bed, well-preserved below the sandy deposit, and the presence of tools 'in situ' make this site a very important one. FOOTE gives the following account of the Hire and Chik Mulangi sites. "A great bed of gravely kankar, with quartzite shingle and a few large chipped implements of good quality, occurs between Hire and Chik Mulangi, about 20 miles above Kaira (i.e., Khyad)".[3]

7. CHIK MULANGI (21-3-1952)

This village is a satellite (Chik means small) of the bigger village, Hire Mulangi, upstream. The left bank of the river on which this village stands is flattish, without any prominent cliff, and the gravel occurs in the form of spread as at Khyad further away. The nature of the gravel is the same as described in site No. 6. A remnant of an old cliff containing conglomeratic gravel can be observed in the river-bed. Both in this and in the gravel spread, implements occur in large numbers.

The land adjoining both the Mulangi villages is barren, exposing everywhere a brown sandy deposit, and is extremely gullied by small streams emerging from the northern hill-range.

8. ALUR (TALAKVAD) (19-3-1952)

(There are two villages on this river with the same name Alur. One is Hole-Alur, a railway station, and the other is Alur near the village Talakvad; hence, the second Alur is referred to as Alur-Talakvad throughout this book.)

2. For this and other cliff-sections see Figs. 6-10.
3. FOOTE, *op. cit.*, p. 242.

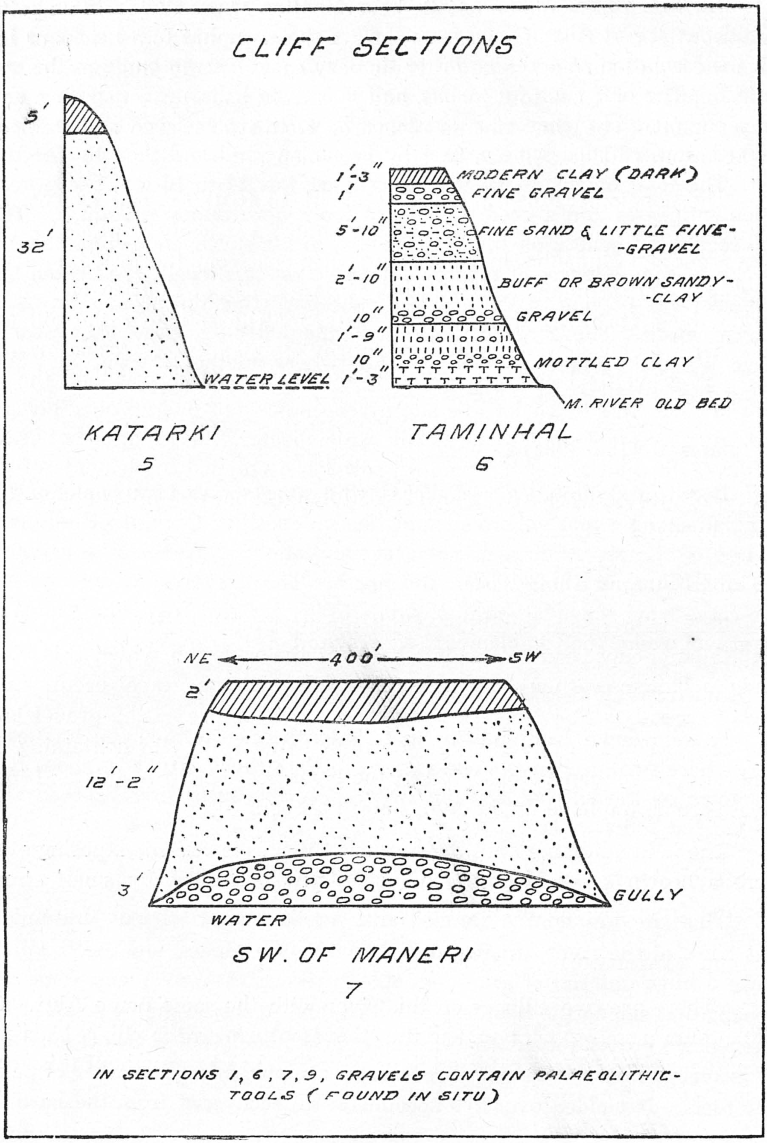

CLIFF SECTIONS
5'
32'
WATER LEVEL
KATARKI
5
1'-3"
1'
5'-10"
2'-10"
10"
1'-9"
10"
1'-3"
MODERN CLAY (DARK)
FINE GRAVEL
FINE SAND & LITTLE FINE-GRAVEL
BUFF OR BROWN SANDY-CLAY
GRAVEL
MOTTLED CLAY
M. RIVER OLD BED
TAMINHAL
6
NE
400'
SW
2'
12'-2"
3'
GULLY
WATER
SW. OF MANERI
7
IN SECTIONS 1, 6, 7, 9, GRAVELS CONTAIN PALAEOLITHIC-TOOLS (FOUND IN SITU)

Fig. 7.

Further downstream, about 4 to 5 miles from Chik Mulangi, is a magnificent site at Alur (Talakvad). Here the river has taken a sharp bend with the formation of a valley flat to the south and a steep bank on the opposite side. The cliff runs for nearly half a furlong's distance, exposing on its face a complete sequence of river deposits, with a gravel-bed at the bottom, followed upward successively, first by brownish sand and then by the black soil.[4] The total height above the water-level was 14 to 16 ft. The gravel is implementiferous and a good number of tools were removed from it. There is no section anywhere on the Malaprabha, so far surveyed, comparable with this one in completeness of record. The river at this locality has eaten away a considerable portion of the village land, converting the occupied area into a sandy waste. This river activity is augmented on a large scale near the village Wasan, a mile south-east of Alur, where another stream, Jaul Halla, coming from south-west, joins it.

9. Budhihal (18-3-1952)

Between Budhihal and Kallapur, the river shows high banks of 15 to 20 ft., all along exposing brown and black deposits. Opposite Budhihal, in the bed of the river, there is some accumulation of gravel at the junction of a small stream coming from the north. The gravel does not appear to have come from the small stream, since it was dry and free from gravel. In this gravel, some good implements were found.

10. Kallapur (18-3-1952)

A mile down Budhihal, a small outcrop of granite-gneiss crosses the river, where two implements were found in the gravel. Further, about half a mile down on the left bank of the river, there is a little gravel-spread which also yielded some tools.

11. Megur-Asoti (or Menasgi) (2-3-1949 and 28-1-1950)

This site lies on the Benni-Halla, an important affluent draining the right bank of the river. In its bend, between the Megur and Asoti villages, occurs a huge outcrop of granite-gneiss (strike ENE-WSW) and some veins of pegmatite, among the boulders of which, and in the adjoining small stream, an extensive gravel-spread (measuring approximately 600 × 350 ft.) is found. The gravel is very coarse and rounded and contains a large number of palaeolithic tools. It yielded over 200 specimens, all recovered from the hard con-

4. See Plate VII.

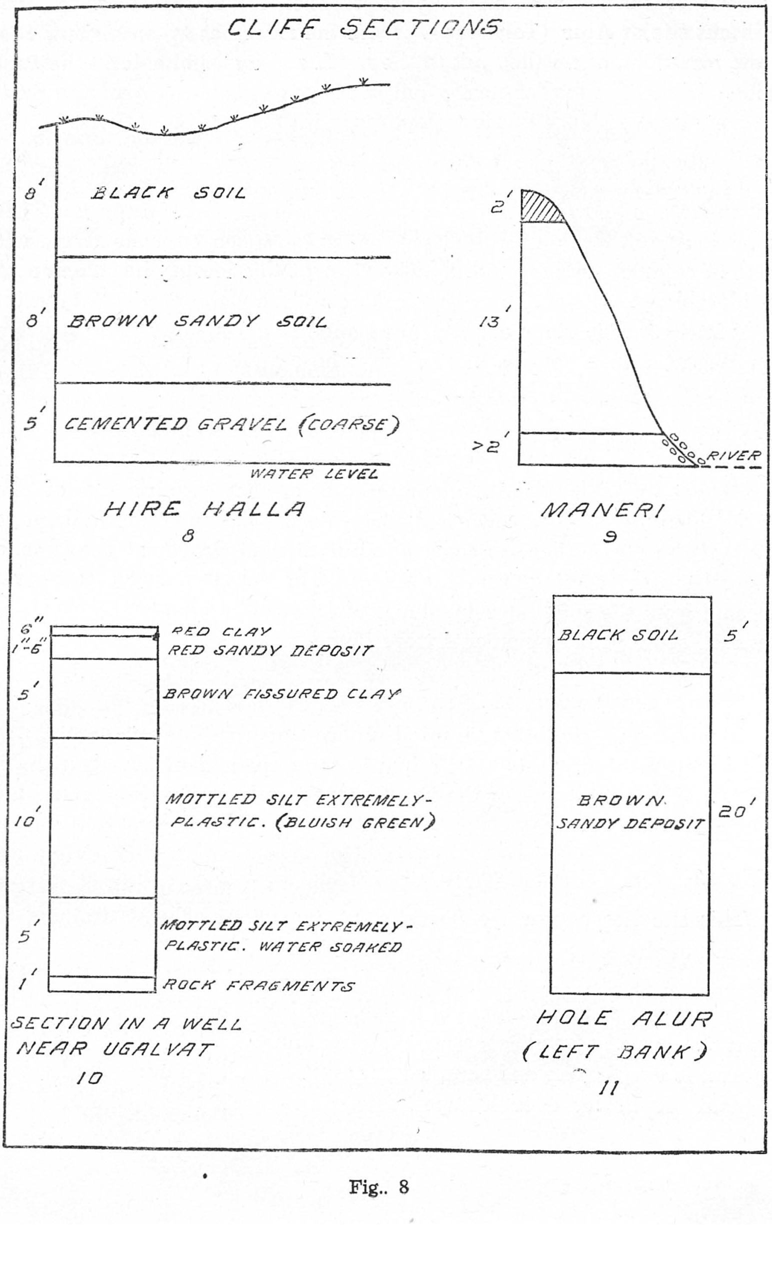

CLIFF SECTIONS
8'
BLACK SOIL
8'
BROWN SANDY SOIL
5'
CEMENTED GRAVEL (COARSE)
WATER LEVEL
HIRE HALLA
8
2'
13'
>2'
RIVER
MANERI
9
6"
1'-6"
RED CLAY
RED SANDY DEPOSIT
5'
BROWN FISSURED CLAY
10'
MOTTLED SILT EXTREMELY-PLASTIC. (BLUISH GREEN)
5'
MOTTLED SILT EXTREMELY-PLASTIC. WATER SOAKED
1'
ROCK FRAGMENTS
SECTION IN A WELL NEAR UGALVAT
10
BLACK SOIL
5'
BROWN SANDY DEPOSIT
20'
HOLE ALUR (LEFT BANK)
11

Fig.. 8

glomeratic gravel. Surprisingly enough, no section was noticed at this place. The banks of the stream are very low and consist of brown or yellow sandy deposit mixed with mottled yellow clay. The water, here, forms beautiful rapids.

On the right bank of the nullah, about a mile upstream from its confluence with the river, a cliff shows 8 ft. of black soil at the top, with 10 ft. brown sand below and some gravel without any implements.

This is one of the most important sites on the Malaprabha river, which gave hundreds of tools, the only unfortunate thing being the absence of a clear section.

Foote records the following observations about this site : "Two beds of Kankar-cemented shingle, one in the Malaprabha and the other in its tributary the Bennihalla, yielded a large number of fine, well-shaped and mostly large-sized chipped quartzite implements, some of which were firmly cemented into the mass and required considerable labour for their extraction. In the former bed, which occurs at Kaira (Khyad) on the left bank of the Malaprabha, five miles south by east of the town of Badami, the gravel bed is seen in the bank of the river at ordinary flood level; in the second case, the gravel occurs in the middle of the stream bed, three miles south of the junction of the Bennihalla and the Malaprabha."[5]

12. Alur (Hole-Alur) (3-3-1949 and 27-1-1950)

This is a station on the Southern Railway and lies on the right bank of the Malaprabha river. On both the up and down-stream sides of the river at this place, the cliff-sections are exposed for a distance of over three miles. In one section on the right bank of the river, and on the way to Gadgoli, three horizons are visible. The upper-most layer of modern dark-coloured soil is 4 ft. thick. Below this is a deposit of brown sand which overlies the mottled silt at the bottom. Only a few tools were collected from this site.

13. Taminhal (29-1-1950 and 29-12-1950)

At Taminhal, on the left bank about two miles from Alur, a complete and perfect section was observed in a nullah adjacent to the old river-bed. Here, the river has cut its meander and is now following a different course, about four furlongs south of the cut portion. The section from top to bottom shows modern clay of a foot and three inches in thickness underlain by a layer of a foot of gravel, and this is further followed imperceptibly by fine

5. Foote, *Ibid.*, p. 242.

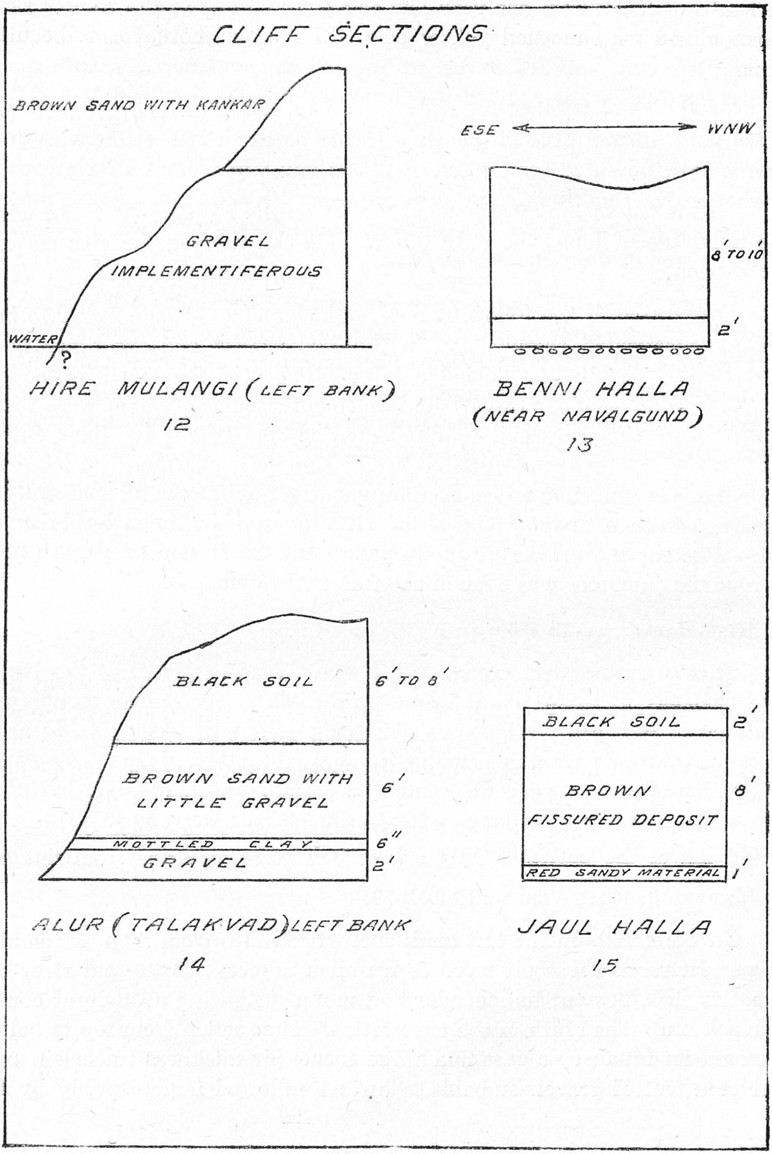

CLIFF SECTIONS
BROWN SAND WITH KANKAR
GRAVEL
IMPLEMENTIFEROUS
WATER
?
HIRE MULANGI (LEFT BANK)
12
ESE
WNW
8' TO 10'
2'
BENNI HALLA
(NEAR NAVALGUND)
13
BLACK SOIL
6' TO 8'
BROWN SAND WITH
LITTLE GRAVEL
6'
MOTTLED CLAY
6"
GRAVEL
2'
ALUR (TALAKVAD) LEFT BANK
14
BLACK SOIL
2'
BROWN
FISSURED DEPOSIT
8'
RED SANDY MATERIAL
1'
JAUL HALLA
15

Fig 9

sand, with a few pebbles, to a depth of about 4 ft. Below the sandy material is brown clay and then a thin (10 inches) layer of gravel. The lower portion is of mottled clay, and partly embedded in it are big pebbles and the tools. The mottled clay appears to be resting on the weathered granite-gneiss which is exposed on the right of the section on the old river-bed

During a second visit to this place, some portion north of the village up to the foot of the hill including the small streams, was observed for ascertaining whether the implements were coming from the hill. The streams are dry and silted, and none of them contains any tools. These were not found either in the fields or in the talus deposit.

Before proceeding to the next site on the Hire Halla, it is essential to record the observations of the river between Taminhal and Katarki. Near Holi Hadagali, the river takes a sharp bend and forms a crescent-shaped sandy flat on one side and high-mud-cliffs on the other. About half a furlong upstream from this village, a pegmatite dyke goes right across the river but without impounding any gravel near about it.

The Katarki village stands on a very high cliff, nearly 30 to 40 ft. in height, consisting of about 5 ft. of black soil at the top and the rest of brownish sand. Whether the gravel-bed exists below the sandy deposit could not be observed, as the water was deep at the foot of the cliff.

14. Hire-Halla (28-12-1950)

This is another big stream, which flows almost parallel to the Benni-Halla and meets the river about 5 miles below Alur. The nullah, though very shallow and silted, has developed its right bank quite well. On this side, about a furlong upstream from its confluence with the river, it shows a perfect section ; bottom-gravel rests on weathered granite, and is overlain by brown sand, while above that lies black soil, the total height being 20 ft. Two small and one fairly big hand-axes were collected from the gravel. (See Fig. 8).

15. Maneri (South-West) (28-12-1950)

This site is between the confluence of the Hire-halla and the Maneri village. Here, on the right bank of the river, a very magnificent cliff runs for nearly 400 ft., exposing the three common deposits, gravel, brown sand and black soil. The cliff is almost vertical, standing out of deep water, which prevented its detailed examination. The gravel is well cemented and yielded one hand-axe. The opposite bank is low. (See Fig. 7).

6. See the generalized cross-section, Fig. 10.

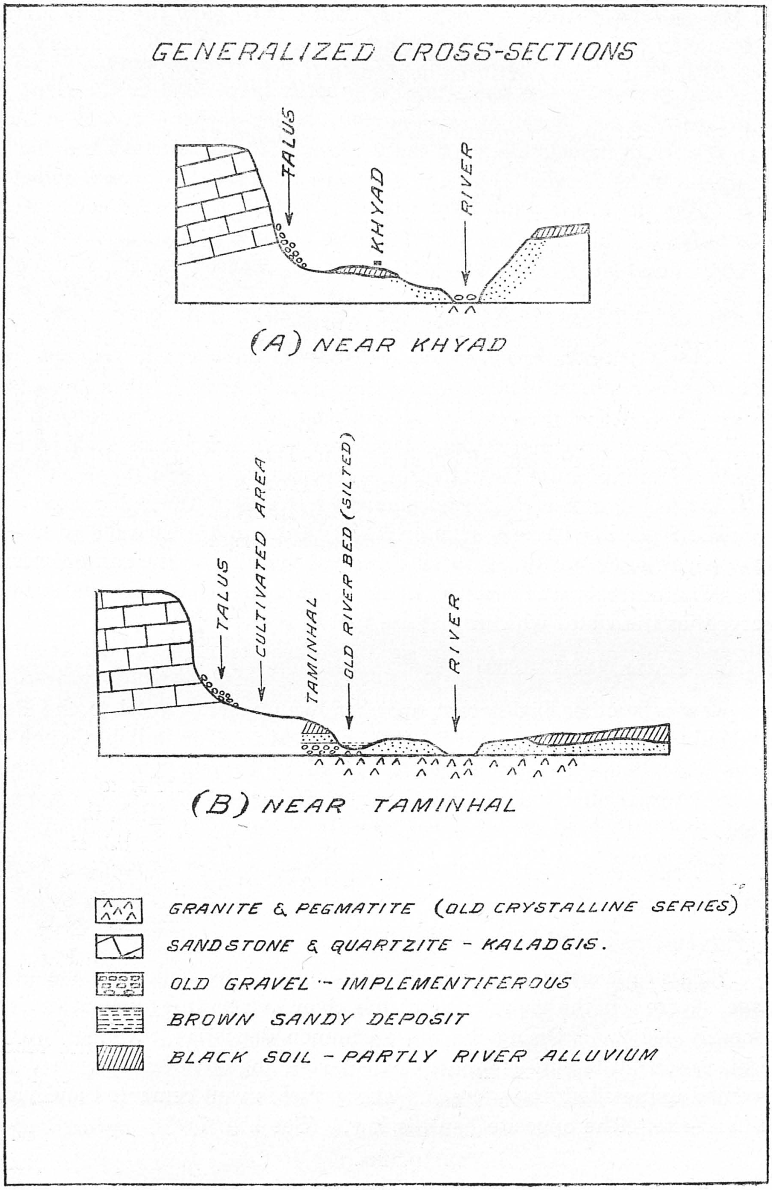

GENERALIZED CROSS-SECTIONS
TALUS
KHYAD
RIVER
(A) NEAR KHYAD
TALUS
CULTIVATED AREA
TAMINHAL
OLD RIVER BED (SILTED)
RIVER
(B) NEAR TAMINHAL
GRANITE & PEGMATITE (OLD CRYSTALLINE SERIES)
SANDSTONE & QUARTZITE - KALADGIS.
OLD GRAVEL - IMPLEMENTIFEROUS
BROWN SANDY DEPOSIT
BLACK SOIL - PARTLY RIVER ALLUVIUM

Fig. 10.

16. Maneri (28-12-1950)

Just opposite the village, in the bed of the river, outcrops of granite-gneiss and pegmatite are seen running practically parallel to the right bank of the river. A considerable gravel-spread, similar to that observed at Megur-Asoti, occurs in association with these rocks. It yielded good and big-sized specimens of hand-axes, choppers and cores. The right bank consists of brown sand 13 ft. from the bottom and is topped by 2 ft. black soil. The opposite bank is low, but the gravel here is not much disturbed and is overlain by mottled silt and brown sand. (See Fig. 6).

17. Khyad (3-3-1949; 29-1-1950 and 26-12-1950)

This is a most important site. It yielded hundreds of tool specimens, and has still an almost inexhaustible reserve in its gravel. It is undoubtedly a palaeolithic factory site, as the tools not only occur in large number but also are of different sizes and types. The river here has taken a sharp curve, which has facilitated the formation of a very extensive gravel-spread for half a mile in the bed of the river adjoining the left bank. There are big outcrops of pegmatite in the river near the village, and another of pink granite two furlongs further downstream. Well-cemented gravel is mixed up in the rubble of these outcrops, and it appears to be resting on them. All the rocks are highly weathered into whitish gritty clay. The right bank is fairly high and steep and consists of 12 ft. brown sand at the bottom, capped by about 2 ft. black soil.[7] What exactly underlies the sand is not known but, judged from previous observations at different sites upstream, it must in all probability be a gravel-bed. The brown sand is much disturbed on the left bank, which is only 6 to 8 ft. high and gullied by small streams coming from the north. In some of these gullies, below the brown sand, yellow mottled clay-silt is visible.

Foote's observations of this site have been quoted while describing the Megur-Asoti site.

18. Khyad-Dhank Sirur (27-12-1950).

Below the village Khyad, the river again takes a close-meandering course, almost a hair-pin bend. It has straightened up at this place by cutting its bank (not shown on the Survey of India topo-sheet). A furlong downstream from this bend, a beautiful section is visible. Its height is about 14 ft. above the water-level; and from its bottom upwards it shows gravel with a few implements resting on pegmatite, which is further covered, succes-

7. See the generalized cross section, Fig. 10, and the cliff sections, Fig. 6.

sively, by pale brown kankary deposit and black soil. The talus of the black soil obscures at some places the underlying gravel.[8]

In the bend mentioned above, the river has cut a steep cliff (about 20 ft.) on its right bank, which consists entirely of black soil.

19. Dhank Sirur (27-12-1950).

Opposite this village, in the river bed, is a small spread of gravel which contains a few implements. In the village a gravel bed was found at a depth of 30 ft. from the surface, and above the gravel was a layer of 10 to 15 ft. of fine sand and black soil.

20. Sasive Halla (27-12-1950)

Beyond Dhank Sirur, the river receives a small stream, Sasive Halla, from the south-east. About two and a half furlongs from its confluence with the river, there is an outcrop of pink granite in the bed of the stream, in association with which gravel deposit occurs. The gravel yielded some good specimens of implements. The stream has low banks consisting only of brown sand.

21. Cholachgud (24-12-1950)

After the confluence with the Sasive Halla, the river, with a slight sweep, crosses the quartzite ridge through a gap near Cholachgud. Here it has deposited some gravel on the bank, from which one hand-axe was recovered.

8. See cliff sections, Fig. 6.

SECTION III

STRATIGRAPHY

Modern or Surface Soils

The surface soils occurring in the Malaprabha basin can be distinguished as (1) Black soils and (2) Red or dark brown soils; the former being confined mainly to the south of the river, the latter to the north. The black soils are partly river alluvia deposited by the river or its tributaries; the so-called black cotton-soil of the Dharwar area, which occupies an extensive tract, is decidedly very old. It is very deep and homogeneous, and lies directly upon the gneisses and other metamorphic formations from which it is supposed to have been derived.[1] The black coloration may be attributed to the pre-existing woody vegetation. It is of the reguroid type, clayey in texture and plastic. After the rainy season, it develops deep cracks. Near the outcrops of sedimentary Kaladgis the intercalations of sands have changed its texture from clayey to sandy-clays.[2]

Owing to its great depth, it is hardly possible to get a clear section through the black cotton soil and thus fully to understand its formation. A few big streams, which pass through the "black-plain" of Dharwar have, however, exposed some good sections.

The kankar nodules are found at all depths, though their frequency is greater at the lower levels. The deep black colour of the soil changes to dark brown towards the southern bank of the river, where it shows a distinct current-bedding.

At Hole-Alur, its behaviour is curious. Within a depth of four feet its humus content decreases with increase in the clay portion.[3] Between Manoli and Ramdurg, there is another area of dark soils. Here, the surface soils rest partly on quartzite, but mainly on Manoli-clay-schist and limestone.

The red soils occur to the north of the Badami quartzite ridge. They are mostly sandy, though on the surface the content of clay and silt is appreciable. A part of the present soils may be of lacustrine origin as suggested

1. Foote, *Geology of South Mahratta Country, MGSI,* XII, p. 251.
2. See the soil-analysis tables, pp. 41-43.
3. See soil-analysis tables (Hole-Alur soils).

by FOOTE.[4] To the south of Badami, near Shivapur, a deserted village on the Saraswati Halla, a large number of gastropod shells[5] were collected from the adjoining soil. They were encrusted in the reddish loamy soil so firmly that many of them broke while removing. The size of the shells varies from ½ to 1½ inches.

At the junction of the Saraswati-halla with the Malaprabha river, and on its banks near Banashankari, an extensive tract of calcareous tufa occurs.[6] It covers nearly two square miles and has a concretionary or quasi-lateritic structure. From the sections exposed in the pits in the betel-gardens and a well, it appears to be resting on quartzites and sandstones of the Kaladgis. Its origin is due to the swampy conditions of the area augmented by damming the stream near Banashankari. The Saraswati-halla joins the river through a deep trench-like valley, the banks of which consist of dark brown or blackish clay. FOOTE mentions this calcareous deposit as a subaerial formation.[7]

The PH values of both the black and red soils are about 8·0. The minerals identified from the black soils (collected near Navalgund and Hole-Alur) are as follows:—

> Abundant opaque iron-ore, quartz, felspar (much weathered) dark brown or green biotite, zircon (very common, in rounded and broken grains), tourmaline (purple, in rounded and prismatic grains); also, traces of garnet, hornblende and epidote. The grains are sub-rounded and heavily stained with iron-oxide. The red soils from Shivapur, Ugalvat and Nagarhal fields have the same suite of minerals. Iron-ore is less, tourmaline and garnet are conspicuous.

Thus there is not much difference in the mineral contents of these soils. The black soil is much weathered chemically; and, though its black coloration may be due to organic contents derived from ancient forests, it is also partly due to the presence of iron-oxides resulting from the weathering of hornblende and other dark minerals, and haematite from haematite-schists of the old crystalline series.

4. FOOTE, *op. cit.*, p. 232.

5. These shells were examined by the Zoological Survey of India and identified as Melanoides (Melanoides) tuberculatius (Miller).

See, FUCH, V. E., "Pleistocene events in the Baringo Basin, Kenya Colony," *Geol. Mag.*, Vol. LXXXVII, No. 3, 1950. "This (Mid. Pleistocene) age is confirmed by the presence of Melanoides Tuberculata (Muller)".

6. FOOTE, *op. cit.*, p. 248. The details of Calcareous Tufa are discussed in a paper "A note on the occurrence of calcareous tufa near Badami", JOSHI, *Indian Sc. Congress*, Vol. III (Abstracts), p. 30, 1953.

7. FOOTE, *op. cit.*, p. 248.

In conclusion, it may be said that some portion of the surface soils, except those along the banks of the streams, is of ancient age. The black soil could not have been formed under the present climatic conditions; it must have borne a woody vegetation,[8] a condition indicating a more humid climate than the present. Perhaps, a part of it dates back to the palaeolithic period. There is a considerable proportion of cleavers in the implements collected in the Malaprabha basin; and since the cleavers are functionally regarded as wood-choppers, one can speculate the existence of a thick forest in this area. Now, as the red sandy soils cannot bear a thick forest-type of vegetation, it must have existed on the black soil only.

BROWN SANDS

Underlying the top-soils near the banks of the river, is a huge deposit of brown sand. It does not show any layers or marks of current-bedding. The lower portion is somewhat coarse, but otherwise it appears almost homogeneous.[9] Its junction with the topmost soil is nowhere sharp; in fact, it practically merges imperceptibly with the upper soil, which has a finer texture and a high percentage of clay. In the majority of the cliff sections observed on the Malaprabha river, this deposit is most prominent, and present everywhere without exception. The thickness of the deposit varies from place to place. At Maneri, Katarki, and Khyad, it forms entire cliff-sections with the underlying gravel lying in the bed of the river in the form of a spread. It does not show aeolian characteristics and seems to have been deposited on the lower gravel in the form of sand-fans by the tributary streams coming from the northern ridge.[10] (This is more or less confined to the portion of the river between Ramdurg and Banashankari). The source of the sandy material is obviously from the sedimentary rocks of lower Kaladgis. FOOTE[11] mentions this deposit as "a lateritic sub-soil" occurring north-west of Kaira (Khyad), and between Somankop and Chamankatti, and that "it does not belong to the alluvium, but is older and most likely subaerial and in part of lacustrine origin."

No fossil was found in this deposit. In a section exposed in the Chikdoli nullah, a tributary of the Ghataprabha river (north of the Malaprabha), FOOTE[12] found fossilised bones of Rhinocerous and numerous shells of Uni

8. De TERRA and PATERSON, *Studies on the Ice Age in India and Associated Human Cultures*, p. 319, 1939. Also see Oldham, *Manual of Geology of India*, Calcutta, p. 415, 1893.

9. See soil analysis tables

10. See Survey of India Topo-sheets, Nos. 48-M (5 and 9).

11. FOOTE, *Geology of the South Mahratta Country*, p. 242.

12. *Ibid.*, pp. 232-233

and Carbicula below the regur or cotton-soil. A large atlas (?) bone, probably of a similar species, was also obtained by the author in a recent visit to this place.[13] FOOTE regards all such ossiferous formations occurring in the southern parts of the Deccan as older than the river alluvia, and this seems quite reasonable from their stratigraphical position below the surface soils. The brown sandy deposit, or at least its upper layers, and the lower layers of the top soils, might then be correlated with these ossiferous formations. The PH of this deposit varies from 8′28 to 8′98 towards the bottom, the rise being gradual. But the percentage of carbonate at different levels does not seem to follow any rule.

It contains the following minerals:—Quartz, felspar, zircon (euhedral crystals) green biotite, tourmaline and garnet. The grains are sub-rounded. The Taminhal specimen of the soil contains muscovite, green biotite and big grains of garnet. In all the specimens, haematite is the important and major constituent.

Thus there is no difference between the mineral contents of the surface soils and this deposit.

In some respects the brown sands of the Malaprabha are similar to the deposits Y and U of the Sabarmati area[14] and possibly indicate the presence of a dry phase subsequent to the deposition of the implementiferous gravel-bed.

CEMENTED OLD GRAVEL

Below the sandy deposit, lies the implementiferous gravel-conglomerate whose relation with the overlying sandy material can be noticed in a number of sections where it occurs in an undisturbed condition, and also at the sites where it is in a sheet form. The sand rests directly on the gravel bed, though at the junction there is a considerable admixture of both. The gravel is well cemented in a conglomerate by calcium carbonate, which has bound a part of the upperlying sand also. (At Gadgoli near Hole-Alur, the sand-kankar forms a distinct bed below the brown sandy deposit.) The cementation of the gravel and sand seems to have taken place in a later period, after deposition.

The conglomerate forms vertical cliffs near Hire-Mulangi, Alur (Talakvad), Maneri (SW), where its thickness ranges from 1 to 10 ft. above the water level. It occurs as a single bed without having any sub-layers. The components are well-rounded pebbles, mainly of quartzite, with a small pro-

13. In January, 1952.
14. ZEUNER, *Stone Age and Pleistocene Chronology in Gujarat*, p. 24, 1950.

portion of pebbles of sandstone, granite, schist, pegmatite and dyke rocks, all varying from 1 to 4 inches in diameter. In a sheet gravel at Khyad, Megur Asoti and in a cliff section at Hire-Mulangi, it is singularly coarse.

The basal part of the gravel-conglomerate is visible at some places only, where it appears to be resting on the mottled silty clay, which in turn overlies the bed-rock. On the other hand, where it occurs in a sheet form as at Khyad, Megur-Asoti, etc., it is intimately mixed with the boulders of the bed-rock (granite and pegmatite) and the mottled clay deposit.

All the palaeolithic tools were recovered from this gravel-bed only, a detailed account of which is given sitewise in Section V. It may be noted here that both the crude and the fine tools come from this gravel-conglomerate irrespective of its lower or upper horizons. Thus there is no stratigraphic eidence for the division of the palaeolithic industry into different phases.

THE MOTTLED CLAY OR SILTY-CLAY

At practically all the places, the gravel rests on the mottled clay deposit, which has various shades of colour, greyish, bluish, or green with tints of brown or almost yellow in colour. It is plastic when wet and forms lumps. Its physical composition is somewhat variable. In most cases it contains a considerable amount of silt or fine sand;[15] e.g. the Taminhal specimen contains a high percentage of silt, while at Shindogi fine sand constitutes about 75%. At Khyad, Megur-Asoti, Maneri and Sasive-Halla, a part of the clay seems to have been derived from the decomposed granite and pegmatite over which it rests. On the other hand, at Shindogi near Manoli, it lies upon the clay schist which might have similarly contributed to its composition. It contains calcium carbonate varying from 8·7 to 20% with PH—ranging from 8·3 to 8·98. Wherever the gravel is absent, this deposit underlies the brown sand described above. Its thickness cannot be determined, for in many cases it is not exposed completely above the water-level. But it does not seem to be more than 4 to 5 ft. thick. A similar deposit has been noticed on the Sabarmati river, the description of which applies well to this material also. ZEUNER writes, "The mottled clay is not a weathering soil 'in situ'. For this it is too well sorted. It is most certainly a water-laid deposit of material derived from the decomposition of bed-rock in a climate with intense chemical disintegration. The absence of red iron compounds makes it resemble many of the Tertiary clays of Europe, some of which are associated with brown-coal deposits and which in all probability were formed in a warm and humid climate. But this does not mean that the period of deposition of the clay is

15. See soil analysis Tables.

contemporary with, or follows at all closely, the period in which the material was formed, so that the problem of the genesis of the mottled clay has for the time being to be regarded as entirely unsettled."[16]

Pre-Gravel River Bed

The present bed of the river lies mostly on the pre-Kaladgi formation, as is evidenced from the outcrops of granite-gneiss and schists of the older series observed at several places on the river. The river seems to have reached its previous level—the level prior to the deposition of the mottled clay—by cutting through the layers of implementiferous gravel and sand. Now judging from the present long-profile of the river, which cannot be called a completely graded profile, it is clear that the river of the pre-palaeolithic period was also not graded.

A note on the deposits obtained in the newly-dug well at Ugalvat.

This place is 9 miles north of the left bank of the Malaprabha river and lies 10 miles north-west of Badami. Five samples of the deposits at different depths were taken and analysed mechanically. The results obtained are interesting. All the deposits from top to bottom contain a large proportion of sand—fine or coarse. The surface soil and the deposit between 2 and 7 ft. contain some amount of organic matter, and the second layer (6 inches to 2 ft.) shows a high proportion of coarse sand (72%) with very little organic content.[17] Thus it seems that the ancient soil was buried under the excessive sandy deposit, which has a pale red colour and a uniform grain size. A new topmost soil was later on formed on this sandy material. The bottom-most samples contain some amount of mottled clay or silt and are pale yellowish-green in colour, and sticky. As no tools or fossils were found in any of these deposits, it is somewhat difficult to interpret the results of their mechanical analysis. But, broadly speaking, their order, from bottom to top, conforms to the one observed in the cliff-sections on the Malaprabha river. It perhaps means that in the past this entire region underwent uniform changes.

16. Zeuner, op. cit., p. 14.
17. See the cliff sections Fig. 8, and the soil analysis Table II.

TABLE I

Soil-Analysis (Mechanical)

Locality	Megascopic character	Moisture %	Carbonate %	C. Sand %	F. Sand %	Silt %	Clay %	PH
1. Taminhal-cliff Lower-most implement bearing.	Slightly yellowish grey, forms lumps, plastic. Yellow when wet.	3·60	8·70	17·42	1·28	65·50	3·50	8·98
2. Taminhal-cliff. Deposit overlying the gravel.	Extremely coarse, hardened due to carbonate, pale brown to pale yellow colour.	0·84	1·40	72·50	7·51	15·00	2·75	8·28
3. Taminhal-cliff top-most soil.	Black cotton soil.	3·17	6·10	1·035	35·445	14·750	39·50	8·00
4. Maneri-cliff. Deposit over-lying the gravel bed.	Brown or dark yellow, loose and coarse.	2·83	3·60	4·39	37·18	14·80	37·20	8·40
5. Saraswatihalla (gastropod-bearing soil).	Brown with purple tints, contains large number of gastropod shells.	1·93	25·00	11·145	31·525	23·675	6·725	8·17
6. Shindogi (near Manoli).	Soft, clayey, pale yellow-coloured.	0·96	20·00	2·35	71·94	1·25	3·50	8·34

TABLE II

Soil-Analysis (Mechanical)

Locality	Megascopic character	Moisture %	Organic Matter %	Carbonate %	C. Sand %	F. Sand %	Silt %	Clay %	PH
1. Ugalvat (0—6″).	Brown surface soil. soil.	1·56	1·254	0·4543	15·650	50·586	17·250	4·500	—
2. Ugalvat (6″—2′).	Coarse, sandy deposit, lateritized fine gravely, dark, red or brown in colour.	0·260	0·7989	0·00	72·710	18·280	5·750	3·00	—
3. Ugalvat (2′—7′).	Chocolate-coloured fine grained material.	2·520	1·309	0·9086	8·150	65·4214	18·250	4·750	—
4. Ugalvat (7′—15′).	Yellowish brown with a pale bluish green tint. (mottled silt).	3·160	—	1·3629	20·205	50·2721	21·500	3·500	—
5. Ugalvat (>15′).	Pale yellow in colour, fine grained deposit.	6·360	—	3·1801	3·250	75·710	9·750	1·750	—
6. Hire Mulangi (overlying the implementiferous gravel).	Pale yellow, clayey sand.	2 640	—	1·3629	37·975	44·2721	9·750	4·000	7·2
7. Bennihalla (Navalgund).	Black clayey soil	6·120	—	4·9973	0·580	60·3027	19·250	8·750	7·2

TABLE III

Soils from Hole Alur

	Depth	Moisture %	Organic Matter %	C. Sand %	F. Sand %	Silt %	Clay %
Locality I (Ridge)	1'	9·6	6·104	6·23	14·21	28·30	35·55
	2'	10·320	4·836	6·64	14·10	12·75	51·35
	3'	10·10	4·349	4·86	7·89	18·45	54·35
	4'	13·50	3·13	4·04	4·58	15·20	62·55
Locality II (Valley)	1'	10·26	7·04	6·94	16·14	36·77	22·85
	2'	10·82	6·60	5·41	17·87	34·65	24·65
	3'	10·52	5·30	8·06	7·32	23·70	45·10
	4'	11·198	4·80	7·51	4·29	21·20	51·00

(All are dark-coloured, the top-most deposit being the well-known black cotton soil)

SECTION IV

PROBABLE CLIMATIC PHASES

Zeuner, while discussing the climatic river terraces, remarks, "The typical climatic terraces are restricted to districts removed from the influence of the changing sea-level, removed from the meltwater of the glaciers (though this is less essential), and situated in tectonically quiet, or fairly quiet, regions. Furthermore, the rivers must have been subjected to the influence of the periglacial climate."[1] This description, except for the part concerning the periglacial climate, applies very well to the Malaprabha basin. The river has no direct access to the sea; and, since the entire basin lies in the southern part of India, it could not have witnessed any glacial or periglacial climates. The tectonic changes in Peninsular India during the Pleistocene period and after have not been properly studied, though there is a possibility of such phenomena.[2] The geographical position of this area is, as stated above, well suited to the formation of climatic terraces. But, in the area so far surveyed, no terrace formation of any kind has been noticed.

From the evidence of the river deposits exposed at several places in the cliff sections, it is difficult to conjecture with confidence the past climatic changes. One is further handicapped by the absence of fossils. But this seems to be a common handicap in India, particularly in its Peninsular area, as is experienced in Gujarat, Mayurbhanj, Madras, etc. The following observations are, therefore, tentative and subject to modification by future work in this as well as in other regions of Peninsular India.

Following Zeuner in his climatic succession in the Sabarmati area,[3] we can summarize the probable climatic changes in this basin as under :

Pm: (?) There is no evidence of the lateritic crust in this area,[4] but the landform over which the mottled clay and the gravel are lying is uneven

1. Zeuner, *Pleistocene Period,* p. 27, 1945.

2. Vrendenburg, "Pleistocene movements and their effects on rivers of Peninsular India", *Geol. Sur. India,* XXXIII, Pt. I, pp. 33-46.

3. Zeuner, *Stone Age and Pleistocene Chronology in Gujarat,* pp. 23-24, 1950.

All the letters given by Zeuner to designate different climatic phases in Gujarat are retained for the sake of convenience. Only "M" is added to denote the Malaprabha river. Viz. Pm; Qm, etc.

4. A note on the laterite observed in this region is given at the end of this section.

and highly weathered (weathered granite and pegmatite have been noticed at several places on this river.)[5] Nothing can be said about the climate. It was perhaps humid.

QM: Mottled clay or silt. This deposit agrees well with the corresponding one in the Sabarmati.

RM: Cemented gravel phase. All the component material of this deposit is not of river origin, but a considerable portion of it appears to be a part of the talus derived from the adjoining quartzite ridge. The rainfall during the formation of this deposit might have been somewhat heavier than it is to-day. But, whether the presence of such a gravel bed suggests a pluvial phase, cannot be said with confidence.[6] The presence of palaeolithic man in this area is evident from the tools found in the gravel bed.

(The river is subject to seasonal floods, and in view of this inherent property of all streams in the monsoonal lands, it is difficult to say whether the gravel formation represents any pluvial phase. The question of pluvials in the regions belonging to monsoonal climates should be studied separately and, as ZEUNER says, India is the most suitable country for such work.)

SM and TM: These phases are not recognized in the Malaprabha river. Perhaps the climatic changes after the deposition of gravel were not so markedly different as to leave behind a characteristic stamp in the form of varied deposits, as the S and T phases in the Sabarmati.

UM: A drier climate prevailed, with the result that the river began to aggrade and deposit large quantities of sand and gravel. The sand is somewhat coarse at the bottom, becoming finer upwards. The unfavourable climatic condition before the beginning of this phase removed palaeolithic man from this area, which he does not seem to have occupied again.

VM, WM, XM, YM: No evidence is so far available in the area surveyed to indicate these phases. A few microliths were recovered from the

5. SANKALIA, SUBBA RAO and JOSHI, "Studies in the Pre-history of Karnatak", *BDCRI.*, pp. 58-59, 1952.

6. See WAYLAND, E. J. (1929) "African Pluvial Periods", *Nature,* Vol. 123, No. 3103. "A change in sedimentation from finer silt to torrential boulder beds is not necessarily evidence of climatic change, much less of a pluvial period. Nor can a pluviation be deduced from the study, however detailed, of a restricted area."

fields adjoining the sandstone hills of Badami, and it is possible that in this part of Karnatak the microliths might belong to almost sub-recent deposits, as in northern Gujarat.[7] The relics of the Iron Age found near Herkal[8] also come from recent deposits. The presence of an extensive field of megalithic monuments[9] in the form of underground dolmenic cists, surrounded by a stone circle, near Manoli may again be mentioned here. All these relics suggest the presence of pre-historic settlements at different periods in this region.

ZM: After the last dry phase, the climate became somewhat moist again or assumed its older and present characteristic of seasonal floods. The energy of the river was expended partly in cutting through the previously deposited sand and basement gravel and partly in developing the flood plain. The river now flowing practically over the pre-gravel phase-foundation, exposes a succession of gravel, sand, and recent deposits in the cliff sections.

From the above discussion it appears that, unlike the Sabarmati, this area does not show several alternating damper and drier phases, nor are they so complex as in the Sabarmati. The position of the Sabarmati region near the sea, and its vicinity to the Tropic of Cancer, as against the interior nature of the Malaprabha basin, may be a cause of the climatic complexities of the former area.

It would be interesting to take account of the pleistocene deposits from the various sites in Peninsular India. Implementiferous gravel, mottled clay (or silty-clay), and a lateritic formation are common associates and are noticed in Gujarat, Mayurbhanj, Madras, and Central India on the Narbada.[10] In the Godavari and Malaprabha basins, the lateritic crust below the cemented gravel is absent. This difference may not signify any separate climatic phase in these regions. The pleistocene climatic succession in Indian Peninsula should therefore be studied zone-wise as follows:

(a) The tract between the Tungabhadra in the south and the Godavari in the north (lat. 16° and 20° N).

(b) Madras and the adjoining region of the Eastern Ghats. (lat. 13° N and less than that).

7. ZEUNER, *Stone Age and Pleistocene Chronology in Gujarat*, p. 25, 1950.
8. PANCHMUKHI, *Progress of Kannada Research in Bombay State*, pp. 49-50, 1948.
9. SANKALIA, SUBBA RAO, JOSHI, *op. cit*, p. 66, 1952.
10. See Part II, Section VI.

(c) Gujarat, the Mayurbhanj tract (lat. 22° to 23° N including the Tropic of Cancer).

(d) The Narbada Basin.

These zones are distinct in their physiographical setting and their different latitudinal positions, the two factors that greatly influence climate. As studies in pliestocene chronology are still at an infant stage in India, it would be risky to say anything more than this; only further work in the above regions could bring forth new clues.[11]

In the absence of fossils from the area surveyed, the palaeolithic industries might be used tentatively to assess the relative age, though this would be a thoroughly faulty procedure.[12] On a typological basis, the implements belong to the middle or upper-pleistocene period.

The Malaprabha industry can well be compared with that of Gujarat. But, even in that region, the climatic succession has not been finally established; on the other hand, ZEUNER remarks that "the situation is more complex."[13] "On the other hand, if one chooses to correlate the Sabarmati cemented gravel with the upper cemented gravel on the Godavari at Nandur, the industry would be contemporary with *Elephas Namadicus,* a fossil also known from the upper gravel of the sequence of the middle Narbada." This zone is correlated by De TERRĀ[14] with the Penultimate Glaciation. Consequently, the age of the Malaprabha industry may be the same, which, according to ZEUNER, would be 150-200,000 years B. P.

The following observations of Drs. HORA and BANERJI[15] may also be considered in connection with the general behaviour of the climate of the semi-arid tracts of Peninsular India, which include the Malaprabha basin :—

11. "The whole problem of the relation of tropical pluvials to glacial phases needs fresh consideration, and India affords particularly favourable conditions for such work." ZEUNER, *op. cit.,* p. 43.

12. ZEUNER, *The Pleistocene Period,* p. 1.

13. ZEUNER, *Stone Age and Pleistocene Chronology in Gujarat,* p. 43-44.

14. De TERRA and PATERSON, *op. cit.,* p. 321.

VRENDENBURG regards all the ancient fossiliferous gravels as of an identical age. "In the case of the Peninsular rivers, the accumulation of ancient fossiliferous beds could only have taken place at the particular period when the warping occurred, with the consequence that, wherever present, these gravels belong to one age." *Op. cit.,* p. 43.

15. HORA, S. L., "Significance of the semi-arid tract of the Deccan plateau in the distribution of Plants and Animals," *Symposium on the Semi-Arid tracts of Peninsular India and their development, National Institute of Sciences of India,* p. 25, 1952.

"The fluctuation in the climate from arid and humid has been recognised in India during the last 2,000 years. According to Dr. BANERJI, the rise of temperature during the last 2,000 years would be 10° C which means that India was appreciably colder in the beginning of the Christian Era." Dr. HORA, after AUDEN, says that "the aridity of the Deccan plateau between the two Ghats seems to have occurred again and again during the Interglacial Periods of the Pleistocene. During the Pluvial periods, the plateau became higher relative to the sea-level owing to the eustatic movements of the sea, the temperature was considerably lower and the humidity higher. Such conditions favoured the growth of thick, evergreen, deciduous vegetation all over the plateau and made it possible for the present-day hilly plants and animals to run over the entire surface of the plateau. During Interglacial periods, owing to the desiccation due to high temperature and low rainfall, the once continuous faunas and floras became isolated for thousands of years and some of the generalised forms developed into new varieties, species or genera according to the nature of the ecological conditions to which they became subjected. . . . ."

If this hypothesis of the sequence of pleistocene climates be accepted it seems that the pendulum of the climate was swinging constantly and almost periodically from semi-arid to humid phases during the palaeolithic period. In addition to this, the monsoonal and, therefore, the seasonal character of the Indian climate has further complicated the issue.

LATERITE IN THE MALAPRABHA BASIN

The laterite-like patches occurring on the Saundatti hills are, perhaps, due to the alteration of ferruginous muds of lacustrine origin.[16] According to Foote the entire laterite formations are older than the older and newer alluvia, including the high-level gravels on the various rivers of this region, and also older than the ossiferous deposit of fluviatile or fluvio-lacustrine origin.[17] Now, since the bottom-set implementiferous gravel belongs to the

16. FOOTE, *The Geological Features of the South Mahratta Country*," *MGSI*, XII, Pt. 1, p. 231. This laterite appears to be of residual type formed from the Deccan Trap.

17. *Ibid.*, p. 224.

See also ZEUNER, *Stone Age and Pleistocene Chronology in Gujarat*, p. 21.

"It is perfectly possible that the lateritic weathering is very much older than the Pleistocene beds. Some workers regard the laterite altogether as a Tertiary formation." He further opines, "On the grounds of the stratigraphical sequence at Kot, Pedhamli, Derol and so on (in Gujarat), the lateritic phase of the Sabarmati may be placed immediately prior to the formation of the mottled clay."

See also, KRISHNAN, M. S., *Geology of India and Burma*, p. 504.

older alluvia, though not occurring at a higher level than the present river bed, the landform of the pre-gravel phase might be contemporaneous with the laterite described above. The absence of any lateritic material below the gravel-bed might be explained by its removal through rapid erosion prior to the deposition of gravel.[18] If the gravel phase indicates a more humid climate characterized by increase in rainfall, the erosion of the previously formed laterite by rain-wash and stream action can be understood. The mottled silt was deposited mostly before the gravel on the 'laterite-free' landform. So long as a conclusive proof of the existence of a lateritic crust below the gravel-bed and the mottled silt is not available, the above statement, though not necessarily wrong, should be taken as tentative. Granting the presence of a lateritic formation in the Malaprabha basin, we can establish the identity of the pleistocene-deposits of this and the Sabarmati area.

18. KRISHNASWAMI, V. D., gives a similar explanation for the absence of laterite in the Narbada valley, see "Stone Age India", *Ancient India,* No. 3, 1947, p. 30, and De TERRA and PATERSON, *op. cit.,* p. 315-316.

PART II

SECTION V

THE MALAPRABHA PALAEOLITHIC INDUSTRY

Introduction

The Malaprabha basin is rich in Stone-Age remains. It contains thousands of implements of which only a representative fraction has been collected during the survey. It shows a complex assemblage of various types of tools, ranging from cruder forms to very fine artefacts, which can further be distinguished by the degree of rolling, weathering and other changes to which they have been subjected since their manufacture. The proportion of such physically affected and unaffected tools in the main and sub-types is given wherever possible and also mentioned while discussing the characteristics of artefacts found at different sites. Even then, this presents a very vague picture of the relative age of the varied implements. Another difficulty encountered in the proper study of these palaeoliths is that there is no stratigraphic evidence to differentiate them into sub-phases, as all of them come from the same gravel-bed.

The following scheme is, therefore, adopted to facilitate a better understanding of the Malaprabha industry.

After a brief note on the raw material of these palaeoliths, all the main tool-types and their sub-classes are first described, taking into consideration the technique and the form of the implements. This is followed by a site-to-site survey of the collection for a correct appreciation of the tools obtained at different sites and under differing conditions. Then a typological comparison of these artefacts with Indian and foreign types is attempted. A detailed treatment is naturally given while discussing the corresponding industries from India. On the other hand, the sites from Africa have been discussed at greater length, because it is with the African palaeolithic industries that the Karnatak industry, and the Indian palaeolithic industries in general, show a close resemblance. Moreover, these two land-masses belong to the non-glaciated regions lying even beyond the periglacial zones, and thus have a somewhat identical geographical setting.

None of the deposits exposed in the several sections on this river has shown the presence of any fossil remains that could have possibly helped in dating the palaeoliths from this basin. An alternative procedure, namely,

the typological comparison, and from that the approximate dating, has therefore, to be resorted to, though it has several disadvantages. Till suitable data in the form of fossils or possible pluvial successions in this region come forth, the results based upon typological study may be accepted as tentative.

RECORD OF THE PALAEOLITHIC SITES AND THE TOOLS

Site	Abbreviation	Specimen Nos.
1. Alur	(A)	1—18
2. Menasgi (Megur-Asoti)	(MNI)	19—241
3. Taminhal	(TML)	242—270; 719; 720.
4. Khyad	(KD or KHD)	271—663; 850, 851, 852. 671—698; 853.
5. Cholachgud	(CHD)	699.
6. Sasive Halla	(SH)	700—707
7. Maneri	(MRI)	708—718
8. Dhank Sirur	(DS)	721
9. Katral	(KTL)	722—726
10. Tallur	(TLR)	727—729
11. Navalgund-Benni-Halla	(NGD)	730
12. Budhihal	(BDL)	731—742
13. Kallapur	(KLR)	743—748
14. Alur (Talakwad)	(ATD)	749—772
15. Chik-Mulangi	(CMG)	773—800
16. Hire-Mulangi	(HMG)	801—809
17. Hirur	(Hirur or H. Tag)	810—825; 855.
18. Chik-halla (near Manoli)	(CH)	854
19. Malaprabha gorge	—	826

RAW MATERIAL, CONDITION AND GENERAL TECHNIQUE OF TOOLS

The quartzite of the Kaladgi series is the chief rock material used in the manufacture of these tools. This is very fine-grained, possesses various shades of colour—red, pink, purple, grey, white, etc.—is hard, and shows the conchoidal fracture, i.e., it has all the qualities that would have been normally required for the working of implements of a better type.[1] The jointed structure is another advantage of this rock, because in a good many tools

1. The Malaprabha collection shows a preponderance of well-worked tools.

possessing keeled faces the two planes which form the ridge are the cleavage planes of the original rectangular block of quartzite. Besides quartzite,[2] the following types of rocks are also favoured by the makers of these artefacts:-

(i) sandstone (red-and purple-coloured, coarse-and fine-grained varieties)
(ii) clay-schist (dirty-green or grey-coloured, well foliated)
(iii) haematite-schist (banded and heavy)
(iv) hornblende-schist (usually weathered and foliated)
(v) granite and pegmatite (the tools from these rocks are crude, as the material is of an inferior quality)
(vi) quartz (colourless, conchoidal fracture)

All the rocks described above are locally available in the outcrops of the Archaeans, Dharwars, and Kaladgi formations in the Malaprabha basin.

Most of the tools are made on flakes, and the proportion of pebble or core-tools is very small. The flakes seem to have been taken by the "block-on-block" technique, from huge boulders of different sizes from the talus lying at the foot of the escarpments. Several such flakes show a prominent bulb of percussion with a wide angle (90° to 125°) between the primary flake surface and the plain striking platform.[3] The secondary trimming appears to have been done at a little distance from the foot of the hills on the banks of the river, for the gravel-bed which contains both the finished and unfinished tools and a large quantity of unworked primary flakes, does not possess the parent cores of these flakes (cores with the negative bulb of percussion).[4]

The lower palaeolithic industries of Madras[5] and the Godavari[6] also show a preponderance of implements worked on flakes. On the other hand, there are numerous pebble-core-tools in the Sabarmati, Mahi, and Mayurbhanj[7] collections. However, on the typological and technological basis, all the tools belong to the Indian Chello-Acheulean culture.[8] From this it appears that the absence of suitable pebbles in the Malaprabha and Godavari rivers and in the Madras area might have compelled palaeolithic man to use the large

2. This rock is similar to the Table Mountain Sandstone (TMS) of S. Africa.
3. See flake-types.
4. Compare, O'Brien, *Prehistory of Uganda,* p. 131.
5. De Terra & Paterson, *op. cit.,* p. 329.
6. Sankalia, *The Godavari Palaeolithic Industry,* p. 7.
7. Bose & Sen, *Excavations in Mayurbhanj,* pp. 118 and 127.
8. See Section VIII.

flakes which were readily obtainable from the outcrops of rocks or from the talus deposits.[9]

In a recent study of the Narbada river palaeolithic industry,[10] it was noticed that this industry also contains a high proportion of tools (choppers, chopper-cum-scrapers, cleaver-like forms, hand-axes and cleavers) made on flakes. This river abounds in pebbles averaging a foot or more in diameter to smaller ones up to 4 to 6 inches in diameter and thus are admirably suited to being dressed into implements. In spite of this readily available pebble-raw-material, it is surprising why the makers of these tools preferred the flakes. It is difficult, therefore, to account for and give a reasonable explanation of the presence of core-pebble tools in one region and flake-tools or a mixture of both in some other region.

Except a few specimens, practically all the tools are very little rolled or weathered.[11] Some of them are so fresh that they appear to have been made quite recently. They do not, therefore, seem to have undergone transportation before their burial in the gravel nor have they been much disturbed ever since. Many of them are stained yellow by the mottled clay or carry patches of kankary sand on the surface. The red staining (due to association with lateritic material) which is commonly observed on the specimens from Mayurbhanj, the Sabarmati, or Madras is practically absent here, except on a few pieces collected on the hill-slopes near the Manoli-gorge.[12] Nor does the desert lustre visible on the implements from Gujarat appear on the Malaprabha tools.

TECHNIQUE.

Judging from the form of the implements and the nature of the flake-scars, we can recognize certain techniques that might have been used in the manufacture of the tools. Roughly there appear to be three types:—

(a) Abbevellian technique: It is characterized by deep flake scars, sinuous edges and irregular cross-sections of the tools. In many tools, a com-

9. (i) JOSHI, "Influence of raw material on the Palaeolithic Industry of the Malaprabha basin." *Ind. Sc. Congress*, Part III (abstracts), p. 39, 1953.

(ii) Vide CLARK, J. G. D., *Prehistoric Europe, The Economic Basis*, pp. 173 and 182 .

10. In January, 1953.

11. These can better be described as "worn," mostly due to thermal action.

12. SANKALIA writes about the patination and staining as follows: "In the case of quartzites, it is not so easy to detect these chemical or molecular changes as it is in flint. Very often the alteration on surface seems to be due to contact with the deposit with which the implement is found, which is really staining and not patination." *Investigations into Prehistoric Archaeology of Gujarat,"* p. 21.

bination of deep flake scars and shallow scar-beds is observed. Moreover, their form is somewhat Acheulean. These, therefore, perhaps indicate an early Acheulean technique. Such tools are comparatively few.

(b) Acheulean technique: A vast majority of the tools exhibit this technique. The implements possess small flat flake scars and are completely worked all round. In such tools both the surfaces are almost smooth, and the edges are slightly sinuous or practically straight. They show an almond-shaped or oval form and a symmetrical biconvex cross-section. A step-flaking is also seen on many tools. In general, the tools are examples of a superior workmanship. Some sort of "cylinder-hammer" or "wood-on-stone" technique seems to have been used in the manufacture of these tools.

(c) Levallois technique: There are only a few flakes in the collection with a faceted platform suggesting a special preparation of the core before giving the final stroke or touch. Nevertheless, they are sufficient to indicate that the prehistoric man of this basin knew the Levallois technique also.

Besides the techniques mentioned above, there are some tools that recall the Victoria West or Tachengit techniques.

It has been already mentioned that the majority of the tools are on flakes which show a wide angle between the flake surface and the striking platform. Perhaps the Clacton technique was used in getting such primary flakes.

A study of the cross-sections of the tools is also instructive. In hand-axes as well as in cleavers, the cross-sections are mostly biconvex and symmetrical. Wherever the primary flakes are partly worked leaving the under-surface unflaked, the sections tend to be planoconvex. In some specimens, particularly in hand-axes, they are sub-triangular showing one keeled surface, while in some tools both the surfaces show mid-ridges and their cross-sections are rhomboid. The cleavers, besides having the usual biconvex cross-sections, have parallelogrammatic, trapezoid, plano-convex, and lenticular sections also. Sometimes, the cross-section helps us to determine whether a certain tool is on an end—or a side-flake, though the bulb is erased, for, in the former, a majority of the tools have biconvex sections, while these are parallelogrammatic in the latter. Tools having irregular cross-sections are very few.

Types and Sub-types.

HAND-AXES.

The hand-axes are made on :—

1. Cores (Pebble)
2. Flakes (End-or Side-flakes)

(1) Hand-axes on cores are further divisible into :—

(A) Pebble-butted.
(B) Fully flaked

(A) Pebble-butted hand-axes :—

(i) Round pebble-butt, elongated, triangular point, marked by bold, large flake scars. *KD*-325[13] (Fig. 11 and p. 103).

(ii) Broad, round pebble-butt, short, thick triangular point, characterized by crude, bold flaking. *KD*-515 (Fig. 11 and p. 103); MNI-239.

(iii) Pebble-butt, almond-shaped, the front neatly flaked into a thick tongue-like point. *KD*-284 (Fig. 11 and p. 103).

(iv) Similar to (iii) but having a pyramidal body and irregular mid-ridge on the upper surface. *MNI*-197 (Fig. 12 and p. 103).

(v) Short, rounded, thick pebble-butt, almond-shaped, with a somewhat triangular point. *TML*-719 (Fig. 13 and p. 103).

(vi) Thick angular butt and sides, with only the front of the upper and under surfaces flaked to give a rounded edge. *KD*-527.

(B) Fully flaked hand-axes on cores :—

(i) Round, flaked-butt, keeled or pyramidal body and projecting angular point, with wavy edge. *KD*-377 (Fig. 12 and p. 103).

(ii) Thick ovates, irregular wavy edge. *MNI*-45 (Fig. 14, pl. IV, and p. 104), 48; *KD*-541.

(iii) Similar to (ii) but with a finely flaked body. *MNI*-23 (Fig. 14 and p. 104); 704, 756.

(iv) Rounded, flaked-butt, flake-scars large and flat; thick point. *KD*-351, 355, 371.

(2) Hand-axes on flakes.

13. The illustrated specimens. For a detailed description of the illustrated tools see Appendix.

All the remaining hand-axes are made on flakes. In some cases it is easy to recognize whether a specimen is made on an end - or a side-flake. But in a large majority these clues have been chipped away. As remarked in Section III, there is no sufficient stratigraphic evidence to distinguish between the better and cruder varieties of tools, and, therefore, one can only say that the collection might indicate a typological evolution from large, thick, pear-shaped hand-axes to smaller, neater, flatter ovates or cordiform or Pipal-leaf[14] shaped ones, perhaps on Levallois flakes.

I. Pointed pear-shaped forms.

(a) Worked on side-flakes; one edge, therefore, thicker (bulb area) than the other. Butt rounded. Boldly flaked on both faces. Thin edge, alternately flaked. Practically all the specimens are rolled. Cross-section asymmetrically biconvex. 708, 722, 274, 337, 276, 121-A.

(b) Butt rounded and flaked; also worked on both surfaces. Scar-beds large and deep. Edges sinuous. No. 21 and 282 slightly retouched near the point. Cross-section approximately biconvex. *MNI*-37 (Fig. 15 and p. 104); 201, 32, 302, 701, 334, 22, 21, 282, 283, 285, 271, 26, 174, 733, 780, 777, 774.

(c) Fully flaked on upper surface, undersurface carries a few scars and is flattish. No. 718 is worked on both faces. A distinct mid-ridge on the front. The tools appear tortoise-like. Butt rounded. Cross-section plano-convex. In all the specimens of this type, the flakes are taken near the butt, probably to facilitate hafting. *MRI*-718 (Fig. 13 and p. 104); 599, 275, 4, 122, 365, 804.

(d) Rounded butt, boldly flaked on both faces. The undersurface is flat, while the front shows a high flat-topped ridge. Cross-section trapezoid, 1-rolled, 2-unrolled, and 1-slightly rolled. All made on end–flakes. No. 46 is square-butted, and No. 805 has a rhomboid cross-section. 38, 424, 46, 805.

(e) Similar to (d) above but having even edges and the cross-section plano-convex. 5-rolled, 4-slightly rolled, 1–unrolled. *HMG*–801 (Fig. 16 and p. 104); *ATD*-758 (Fig. 16 and p. 104); 721, 810, 804, 768, 281, 272, 751 (all on end-flakes); 277 (on side-flake); 710, 367, 52.

14. Ficus Religiosa.

(f) Rounded butt, flaked on both faces with a keel on each of them. Combination of bold, steep, and flat flake-scars. Cross-section rhomboid or parallelogrammatic in the middle or towards point. 2-rolled, 2-slightly rolled, 1-unrolled. *MNI*-39 (Fig. 16 and p. 104); 335, 183, 763, 787.

II. Large or medium-sized, broad and thick, fully flaked butt. Much thinner and sharper, tongue-like projecting point. Broad convex section at the butt, lenticular at the point.

(a) Almond-shaped; all unrolled. *TML*-243 (Fig. 17, pl. I, and p. 105); 54, 42,700 (pl. III).

(b) Elongated oval-shaped and butt slightly pointed. 2-rolled, 3-slightly rolled. 352, 379, 338, 468, 179.

(c) Similar to (a) above, but smaller in size, with neatly flaked body. 305, 299, 344, 482, 249.

III. Elongated oval-shaped, flaked all round.

(a) Somewhat pointed at one end, butt rounded and cross-section approximately biconvex. 4-rolled, 4-slightly rolled, 4-unrolled. KD-910, 374, 736, 370, 376, 743, 363, 158, 295, 770, 330, 49, 17.

(b) Pointed at both ends. Cross-section biconvex. *KD*-297 (Fig. 18 and p. 105); *KD*-288 (Fig. 19 and p. 105); 360, 735, 273, 27.

(c) Similar to (a) above or II (b) but having a flat surface on the sides or on butt, and neatly worked. 1-slightly rolled, 7-unrolled. 671, 307, 287, 312, 348, 304, 278, 616.

(d) Similar to (b) above, with one side showing scraper edge (side-scraper-cum-handaxe).

One face carries a large and deep flake-scar of a flake taken from the end and directed obliquely towards the centre. 1-rolled, 3-slightly rolled.

KD-292 (Fig. 20, pl. III. and p. 105), 289, 293, 291, 30.

IV. Ovates

(a) Rough ovates: fully flaked—*KD*-908; 738, 130, 310.
partly flaked—588, 745, 626.

(b) Perfect ovates; trimmed all round, marked by fine flake scars. Generally thicker in the centre. Section biconvex. 7-slightly rolled, 5-unrolled.

KD-906; 309, 339, 342, 321, 711, 298, 84, 341, 346, 318, 303, 732.

(c) Perfect ovates, smaller in size and showing excellent workmanship. Cross-section biconvex to lenticular. 1-rolled, 6-unrolled. *KD*-315 (Fig. 21 and p. 105), 300, 61, 306, 308, 311, 319 (pl. III).

(d) Truncated ovates with fine flake-scars all round. Section-biconvex. 1-rolled, 4-slightly rolled, and 3-unrolled. 217, 66, 712, 316, 245, 286, 734, 571.

V. ALMOND-SHAPED

(a) Thick and showing crude working. Some specimens have a tongue-like thin point and are, in this respect, similar to II (a) type. 4-rolled, 4-slightly rolled and 2-unrolled. 336, 714, 47, 35, 161, 641, 347, 372, 366, 764.

(b) Thick and fully flaked body. Cross-section biconvex. 2-rolled, 2-slightly rolled, and 1-unrolled. 296, 361, 723, 709, 727.

(c) Perfect almond-shaped. 5-rolled, 3-slightly rolled, and 7–unrolled. *KD*-343 (Fig. 17, pl. I. and p. 105); 62, 58, 57, 485, 381, 63, 320, 353, 724, 349, 851, 802, 737, 731.

(d) Similar to (c) above but of smaller size. 1-rolled, 2-unrolled. KD-909 (somewhat pointed); 324, 703, 673.

VI. CORDIFORMS OR CORDATES

Uniformly small in size, well worked around and showing controlled flaking. Perhaps made on Levallois flakes. Section lenticular to flatly biconvex. All the tools are thin. 4-slightly rolled, 7-unrolled. *MNI*-59 (Fig. 21 and p. 106); *KD*-907; 302, 311, *MNI*-103 (pl. IV) 90, 331, 643, 111, 313, 28.

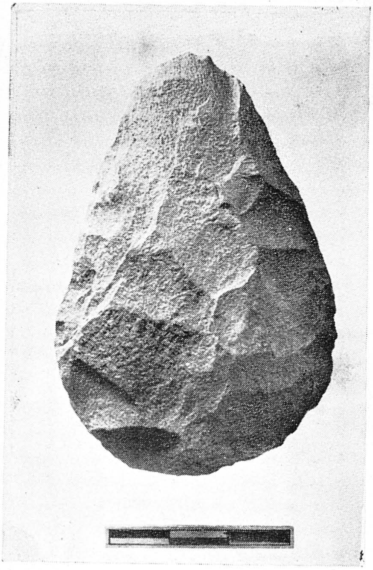
VII. TRIANGULAR HANDAXES

(a) Pear-shaped or triangular, well trimmed all round. Cross section biconvex. All are unrolled. 65, 568, 357.

(b) Sub-triangular. Flaked on both faces. Except No. 435, all show somewhat deeper flake scars. 3-slightly rolled, 5-unrolled. *KD*-435 (Fig. 20 and p. 106); 620, 25, 350, 40, 642, 713, 758, 798.

(c) Triangular or truncated almond-shaped. Consistently worked on end-flakes with a prominent bulb of percussion and having an angle of 90° or 100° between the striking platform and the primary flake surface. Only the front shows a few scars of bold flaking and the undersurface is unworked. All are rolled and weathered.

PLATE I



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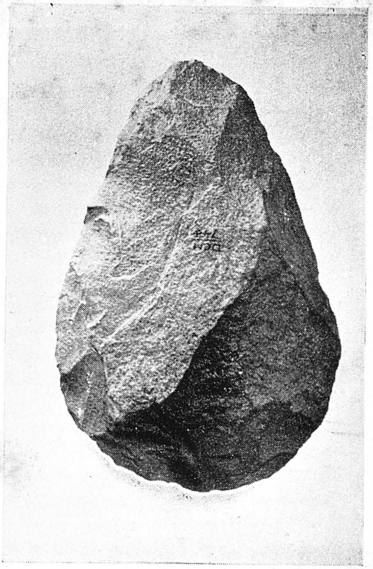

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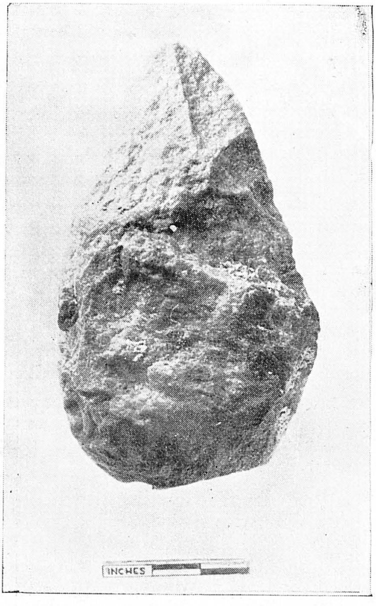

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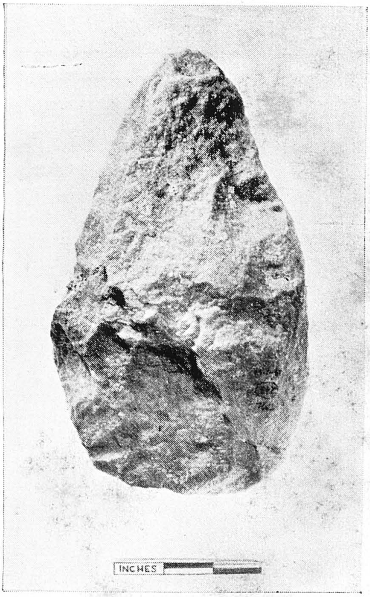
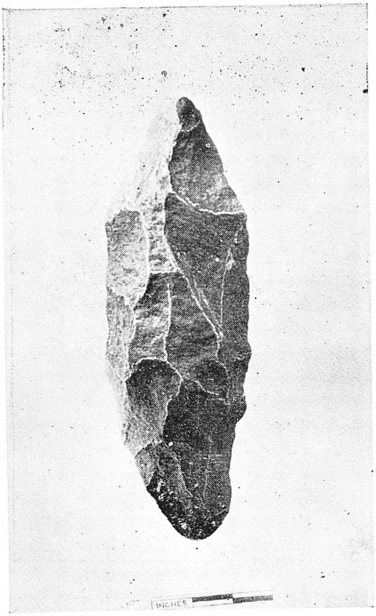


4

(HAND-AXES)

1, 2 (KD-343), Fig. 17, p. 58, 105; 3, 4 (TML-243), Fig. 17, p. 57, 105.

PLATE II



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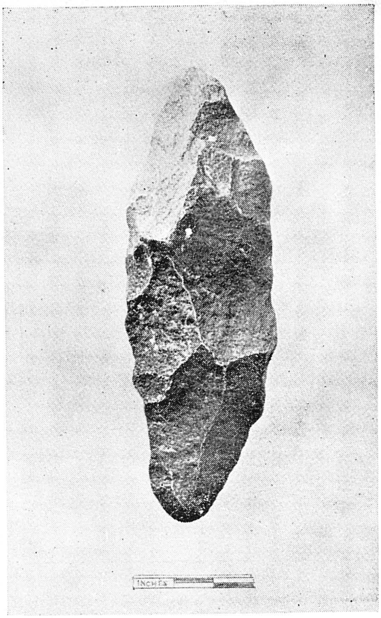

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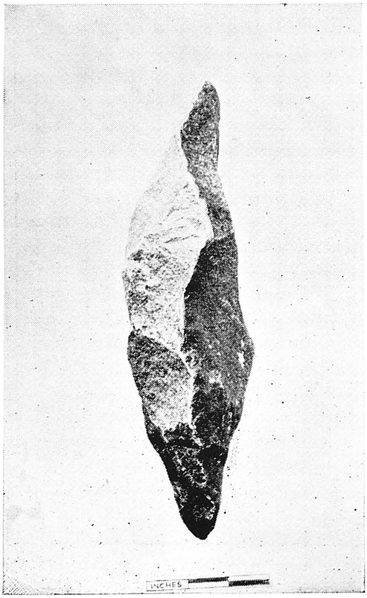

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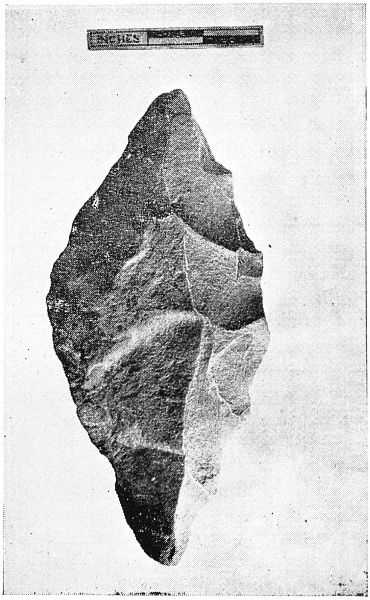

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(HAND-AXES)

1, 2, 3 (KD-853), Fig. 26, p. 60, 107; 4 (KD-288), Fig. 19, p. 57, 105.

Comparable to 'Stellenbosch-I' handaxes on end-flakes.
No. 797 may be called a tri-faced handaxe.
CMG-797 (Fig. 22 and p. 106), *KLR*-744 (Fig. 22 and p. 106); 771, 779, 803.

VIII. CHISEL-EDGED HANDAXES

Practically fully flaked on both surfaces. A short thin, chisel edge, intentionally made by vertical flaking from the point inwards.

(a) On side-flakes: 1-rolled, 3-slightly rolled, 2-unrolled.
44, 139, 138, 328, 362, 559.

(b) On end-flakes: 3-rolled, 3-slightly rolled, 1-unrolled.
KD-332 (Fig. 23 and p. 106); 587, 364, 600, 327, 699, 43, 41.

TOOLS MADE ON FLAT, BROAD, AND RECTANGULAR PEBBLES

(a) Hand-axes on flat pebbles and only partially trimmed into a thin projecting point. Both are slightly rolled.
KD-518 (Fig. 23 and p. 106); 507.

(b) Fully flaked around, leaving flat cortex patches in the centre on both surfaces. 2-slightly rolled, 1-unrolled.
55, 601, 130, 381 (?)

(c) Hand-axe-like, on flat pebbles or parts thereof, and only partially trimmed into a thin projecting point, at times on the upper surface only, sometimes on both, and carried on either side of the tool as well (to give a proper grip to the hand). This fine projecting point seems to have been made by careful vertical flaking as well. These are comparable to the 'Larsen type' hand-axes of S. Africa. Both slightly rolled.

KD-378 (Fig. 24, pl. III. and p. 107); 380.

BURIN OR PSEUDO-BURIN TYPE TOOLS

MNI-139 : Cleaver-cum-burin? One end has a short cleaver edge, the opposite a pseudo-burin facet.

MNI-140 : Probably a real graver or burin with flat surfaces, comparatively thick rounded butt, and the point made by trimming on either side, one side showing a flake scar, the other a series of three or four flake scars. Illustrated. (Fig. 25 and p. 107).

MNI-153 : On a flat side-flake, trimmed on the upper surface and around the butt only, the point perhaps made by a genuine vertical cut. Illustrated. (Fig. 25 and p. 107). Also 19, 155,

PICK-LIKE FORMS

Large and pointed at both ends. Slightly rolled.

KD-853 (Fig. 26 and p. 107).

ROSTROID (?) HANDAXES

A-2 (Fig. 15 and p. 107); 356.

RE-USED TOOLS

Oval or almond-shaped, showing signs of re-use on rolled surfaces. 293, 627.

CLEAVERS

All cleavers are made on flakes, so they are grouped into:

A. Cleavers on end-flakes.

B. Cleavers on side-flakes.

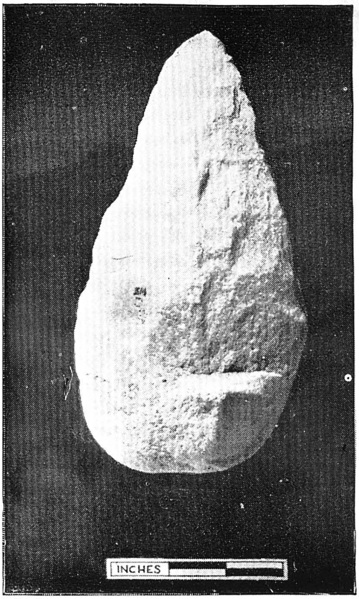
C. Cleavers in which the nature of the primary flake surface is indeterminable, though in the majority of the cases they are most probably on end-flakes as determined by their thickness at the longer or shorter side.

A statistical analysis of the cross-sections of the cleavers is given below:

Cross-section	Perfectly biconvex.	Asymmetrical biconvex.	Lenticular	Plano-convex.	Trapezoid.	Parallelo-grammatic.	Irregular.
Cleavers on end-flakes (total—106)	43	17	—	21	9	14	2
Cleavers on side-flakes (total—36)	4	7	1	4	3	16	1
Cleavers on non-descript flakes (total—26)	8	3	8	1	4	2	—

The table given above shows a higher proportion of cleavers made on end-flakes than those worked on side-struck flakes. The cross-sections along

PLATE III



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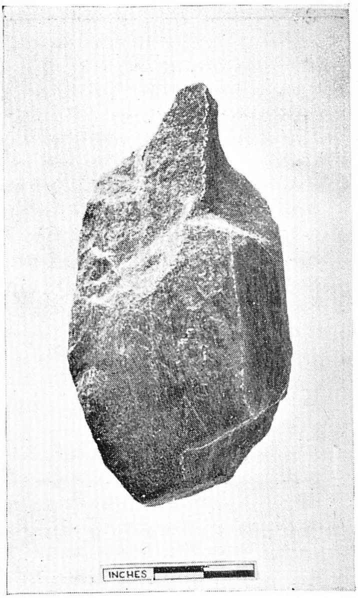

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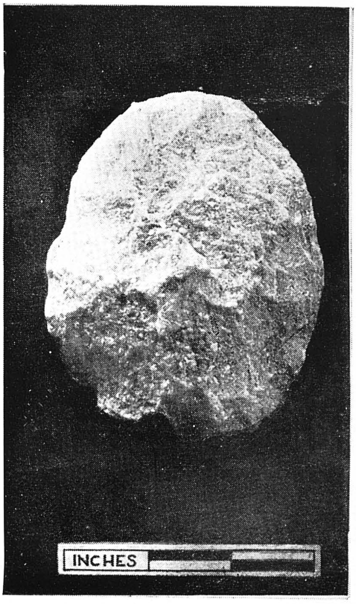
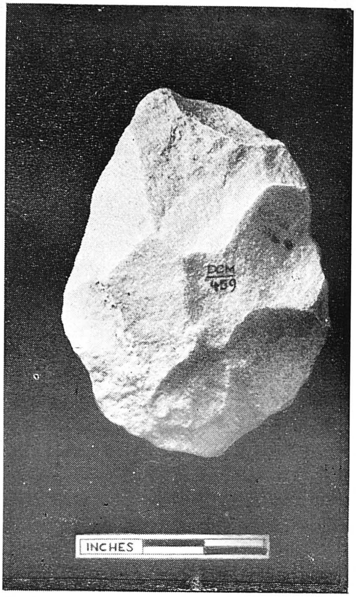


4

(HAND-AXES)

1 (SH-700), p. 57; 2 (KD-378), Fig. 24, p. 59, 107; 3 (KD-292), Fig. 20, p. 57, 105; 4 (KD-319), p. 58.

PLATE IV



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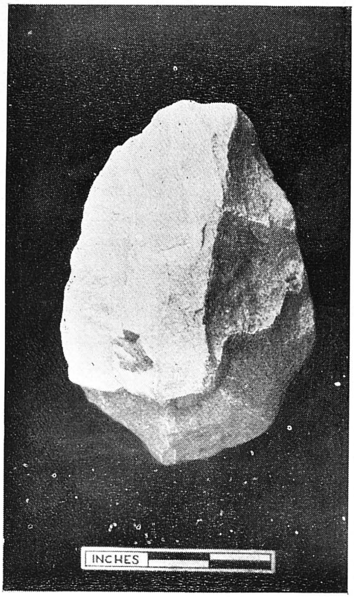

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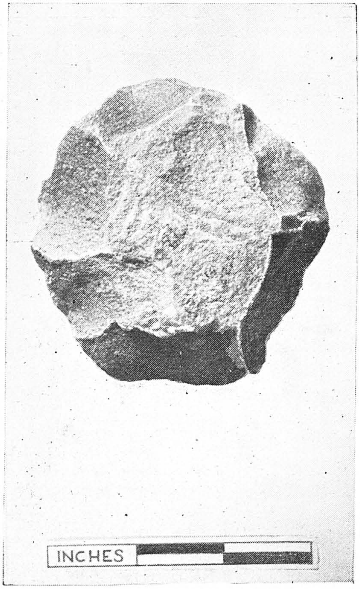

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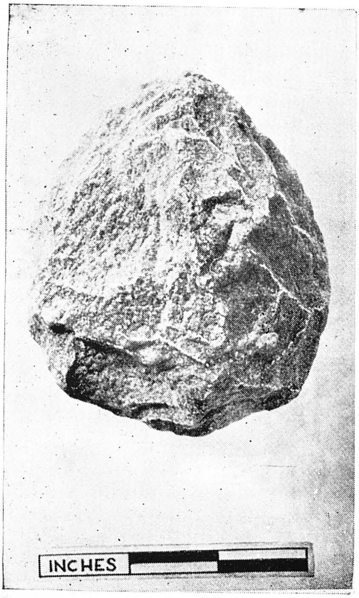


4

(HAND-AXES & DISCOID)

1, 2 (MNI-45), Fig. 14, p. 55, 104; 3 (KTL-726), p. 65; 4 (MNI-103), p. 58.

the minor axis are mostly biconvex in the former and parallelogrammatic in the latter. But, even in cleavers on side-flakes, biconvex sections are equally common. Some specimens possess plano-convex sections and in these the upper surface is more convex than the lower one. The cleavers having trapezoid cross-sections are still fewer.

The cleavers with biconvex sections are generally finely flaked all round. Both these characteristics, viz., biconvexity and elaborate trimming, indicate an advanced technique. This is much more apparent if the cleavers from the Vaal river and Uganda in Africa are considered[15] and typologically compared with the specimens from Karnatak. In Africa, cleavers on side-struck flakes with parallelogrammatic sections and on end-flakes having trapezium cross-sections, generally occur in the earlier stages of the Acheulean. In the later stages, however, the cleavers on end-struck flakes with symmetrical forms and biconvex sections predominate. The Malaprabha collection is a mixture of 'superior' and 'inferior' tools, and, since there is no evidence to differentiate various cleavers stratigraphically, for the sake of convenience they are classified as under, taking into consideration (i) the nature of flaking on the butt and sides, and (ii) the form of the butt and cleaver edge. It does not mean that each of the following sub-types represents a separate type by itself, but only shows at a glance the variety of cleavers in this collection.

A. CLEAVERS ON END-STRUCK FLAKES

(a) Rounded, flaked butt; well-trimmed all over, oblique curved edge. (Guillotine type).
KD-549 (Fig. 28 and p. 107); 163, 124.

(b) Thick, trimmed butt, long oblique (uncurved) edge.
MNI-75 (Fig. 27 and p. 108); 404, 474, 188, 146, 442, 807.

(c) Rounded or little angular and bevelled butt, oblique edge.
HMG-806 (Fig. 29 and p. 108); 425, 72, 436, 602. (No. 806 shows somewhat parallel sides).

(d) Broad, flat-topped and untrimmed butt, oblique edge.
KD-905; 439, 433, 407, 87, 384, 86, 405, 464.

(e) Similar to (d) above but big-sized.
447, 561, 566.

(f) Butt angular and edge oblique.
396, 67, 148, 456, 125, 420, 386, 465, 441, 796, 615.

15. LOWE, *Geology and Archaeology of the Vaal River Basin*, pp. 79-81 and LOWE, *Prehistory of Uganda*, pp. 41, 50, 51.

(g) Butt rounded and trimmed, one face flattish, oblique edge.
KD-903; (also compare *KD*-905); 395, 509, 454, 88.

(h) Trimmed and rounded butt, convex and flaring edge.
KD-421 (Fig. 30, pl. V and p. 108); 339, 76, 402, 391, 783, 402, KD-904 (possibly hafted).

(i) Butt trapezoid or squared, convex edge.
414, 428, 248, 400, 464, 107, 769.

(j) Squared or rounded butt and angular cutting edge.
KD-458 (Fig. 31 and p. 108); 387, 453, 508.

(k) Bevelled, rounded butt, sides parallel, edge angular.
446, 460, 462, 445.

(l) Angular butt and angular cutting edge.
KD-359 (Fig. 29 and p. 108); 475, 472, 94, 432, 340, 576.

(m) Rounded butt and hollowed edge.
KD-426 (Fig. 32, pl. V and p. 108); 403, 556, 459, 809.

(n) Rounded thin butt; convergent sides and straight edge. (somewhat triangular shape).
KD-901; 398, 385, 390, 431, 739, 400.

(o) Similar to (n) above but having one face flat.
450, 427, 808, 784.

(p) Roughly rectangular shape; squared butt; cutting edge straight. (i.e., perpendicular to the long axis).
KD-416 (Fig. 27 and p. 108); *KD*-419 (Fig. 33 and p. 109); 78, 552, 449, 470, 562.

(q) Thick butt and short (chisel) edge.
852, 5, 632, 455, 69, 437, 307, 168.

(r) Oblique and curved edge, comparable to (a); shape somewhat dagger-like.
KD-466 (Fig. 33 and p. 109); 553, 128, 132, 643, 761, 471, 440.

B. Cleavers on side-flakes

1. With a prominent bulb of percussion; under-surface (primary flake surface) completely unworked.

   (a) Oblique cutting edge:

      (i) thin angular butt—*KD*-422 (Fig. 32, pl. V and p. 109). 423, 554.

      (ii) thick butt—*MNI*-74 (Fig. 34 and p. 109).

      (iii) broad straight or little convex butt—594.

(b) Angular cutting adge:

(i) butt squared and sides parallel—644.

(ii) sides convergent—181.

(c) Straight cutting edge:

(i) angular thin butt—583, 618.

(ii) straight or little, convex butt—*KD*-388 (Fig. 34 and p. 109), 563, 557.

2. Bulb erased, with undersurface carrying some flake scars.

(a) Thick butt and oblique cutting edge. 73, 71, 245, 598.

(b) Thin butt and oblique cutting edge. 467, 473, 476, 448, 502, 408.

(c) Angular butt and angular cutting edge. 182, 597.

(d) Angular butt and oblique cutting edge. 757, 144.

C. In all the remaining cleavers, the bulb of percussion is completely removed. They are much flaked.

(a) Sub-triangular in outline; angular butt and convex cutting edge, (probably on side-flakes). 480, 620, 443, 435, 80.

(b) Rounded thick butt and straight cutting edge; sides convergent, (probably on side-flakes). 77, 392, 424.

(c) Convex or rounded butt; oblique cutting edge. 401, 641.

(d) Convex or rounded butt and straight cutting edge. 406, 429, 85, 412, 413, 417, 444, 415.

(e) Conical butt; straight cutting edge. Somewhat similar to (a) above. *KD*-902; 399, 477, 434, 452.

(f) Somewhat angular butt and straight edge. One side alternately flaked (scraper edge?). Probably on side-flakes. 725, 451, 580.

(g) Rectangular shape; thin all round; comparable to ovates in hand-axes. 418.

(h) Probably on side flake; rounded or straight butt and straight cutting edge. Most probably unfinished specimens. *MNI*-151 (Fig 35 and p. 110); *MNI*-152 (Fig. 36 and p. 110); 411, 79.

(i) Perfectly thin, rounded butt; flaking almost all over both the surfaces. Straight edge. Lenticular in cross-section.

(i) *KD*-333 (Fig. 34 and pl. V, p. 110); *KD*-410 (shows "S" twist) (Fig. 28 and p. 110); 50, 478, 160, 430.

(ii) thick butt—392, 424, 77, 799.

Cores

There are a large number of spheroidal or rounded pebbles or lumps of quartzite from which a few flakes are taken without giving any definite shape to the specimens nor producing cutting, chopping or scraping edge or point. These, therefore, may be classed as cores. But none of them is sufficiently large enough to give flakes for preparing the hand-axes or cleavers of varied types found in this assemblage. KD-220 and a few other cores seem to have been used for the production of flakes for making scrapers. Perhaps these, along with the discoids, might have been used as trimming stones—instruments for the dressing (general flaking) of the hand-axes and cleavers.

Pebbles : 793, 789, 773.

Quartzite lumps : 786, 778, 753.

Also : 517, 214, 530, 578, 519, 227, 244, 206, 166, 232, 215, 224, 175, 192, 208, 241, 211, 203, 202, 273, 194, 178, *KD*-220 (Fig. 37 and p. 110).

Choppers

These are made on roundish pebbles or spheroidal blocks of quartzite by slight flaking with alternate strokes, producing an irregular, dull edge or point. A common shape of these specimens is pyramidal or conical with a rounded or flat cortex left at one end to facilitate a proper grip.

(a) Big : 219, 353, 530, 548, 347, 528, 529.

(b) Small : 24, 546, 14, 216, 195, 544, 742, 746, 524 (Fig. 39 and p. 110), 785. *KD*-528 (Fig. 38 and p. 110); *M-Gorge*-826 (Fig. 38 and p. 111), 249 (Fig. 39 and p. 111).

Core-Scrapers

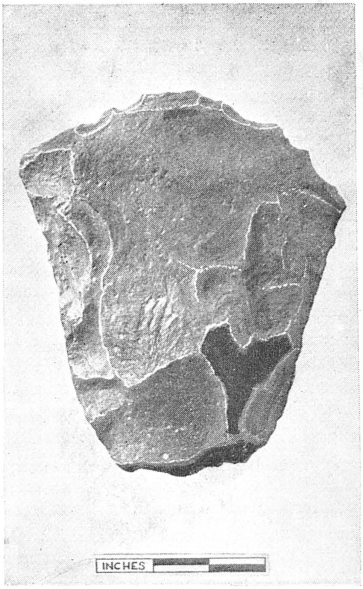
In these specimens, the flaking is more extended and regular than in choppers. The edge is either (i) on half the periphery or (ii) almost around the periphery. Such tools might have been used for rough scraping purposes. These are made invariably on flattish but rolled and weathered pebbles.

213, 204, 217, 538, 229, 623, 102, 233, 596, 794, *CMG*-790 (Fig. 39 and p. 111). *ATD*-760 (Fig. 39 and p. 111); *CMG*-791 (Fig. 39 and p. 111); *KD*-524 (Fig. 39 and p. 110).

Discoids

These are consistently disc-like, bifaced artefacts, polygonal in plan and markedly biconvex or, occasionally, almost bi-pyramidal in section. They resemble well-domed 'circular' tortoise cores. The flaking is almost around, and the majority of the specimens show fine, flat flake-scars, perhaps indicating the "cylinder hammer" technique.

PLATE V



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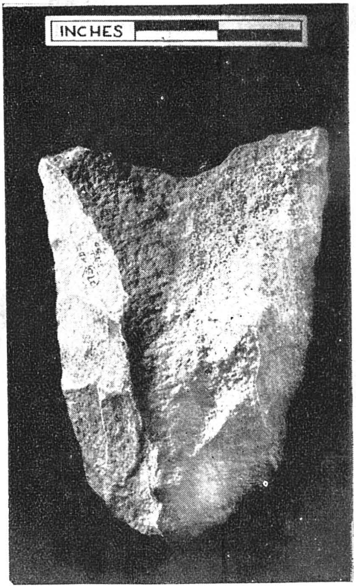

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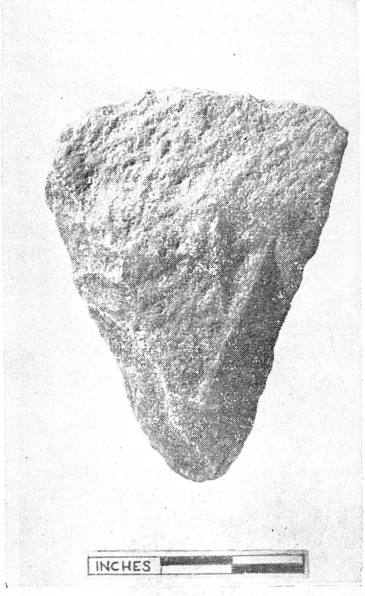

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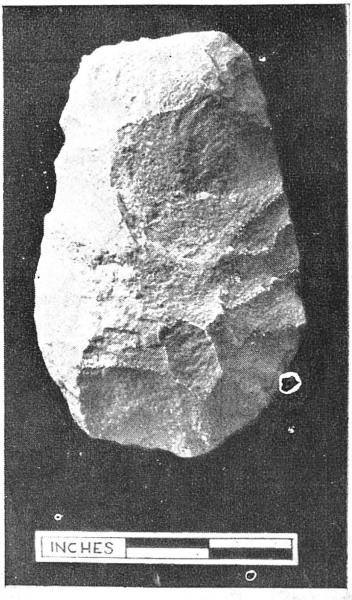


4

(CLEAVERS)

1 (KD-421), Fig. 30, p. 62, 108; 2 (KD-426), Fig. 32, p. 62, 108; 3 (KD-422), Fig. 32, p. 62, 109; 4 (KD-333), Fig. 34, p. 63, 110.

It is difficult to make out for what purpose these circular implements were prepared. They seem to have no use for digging, cutting or scraping. Most probably they were used as secondary tools (small hammers and fabricators) for trimming finished implements like hand-axes and cleavers. Some of them could have been used as bolas stones as well.

(i) 593, 535, 484, 495, 92, 169, 205, 574, 500, 617, 540.

(ii) 728, 482, 97, 95, 705, 170, 486, 494, 101, 481, 492, 489, 759, 747.

(iii) 726 (See pl. IV), 91, 487, 490, 99, 100, 488, 195, 104, 98, 10, 93, 754, 795, 748.

FLAKES

The flakes form a considerable proportion of the specimens collected from the Malaprabha river basin. They invariably show a wide-angled unfaceted platform and a fairly prominent positive bulb of percussion. They may be roughly grouped as under :

1. Flakes having two or more positive bulbs without any secondary working.
2. Flakes with one face further trimmed and the bulb on the other surface left intact.
3. Flakes which are much worked but are not the finished tools. The bulb is absent but the technique could be understood.

In each group further divisions can be made according to their size.

Only 5 or 6 flakes in this collection could be called Levalloisian flakes with faceted platform viz. KD-547 and MNI-137. Though their number is very small, they are sufficient to indicate that the palaeolithic man of the Malaprabha basin had knowledge of this technique also.

Only a few flakes are mentioned here :—

(1) *MNI*-164 (Fig. 40 and p. 111).

(2) 590, 624, 572, 583, 165, 854, 13, 619, 114, 613, 171, 137, 60, 6, 595, 775, 765, 96, 294, 163, 115, 250, 658, 656, 8, 662, 260, 749, 762, 740, 741. *KD*-547 (Fig. 40 and p. 111); *TML*-270 (Fig. 40 and p. 111); *CMG*-776 (Fig. 41 and p. 111).

(3) 532, 246, 159, 142, 153, M. Gorge (Fig. 41 and p. 112), etc.

(4) Unfinished hand-axe, 580, 491, 505, 582, 555, 609, 369, 49, 766, 750.

(5) Unfinished cleaver, 565, 121, 177, 145, 167, 782, 792.

(6) Flakes with butt, the upper and under surfaces flaked. True side-scrapers. *SH*-706, *MRI*-717 (Fig. 41 and p. 112), *H-Tag* (Fig. 41 and p. 112).

SITE-WISE DISCUSSION ON THE PALAEOLITHIC COLLECTIONS

The conditions in which palaeolithic tools are available, as is evidenced from their description given in Section II, vary from site to site. So, for the sake of convenience and also for the better understanding of their characteristics, all the sites are grouped as under:

I. Sites at which the artefacts are in stratified deposits, i.e. lying in the gravel-conglomerate and covered by the sands and recent soils, and are, therefore, in a perfectly undisturbed condition or "in situ". The best examples would be the Hire Mulangi, Alur (Talakwad), Maneri (SW), Hole-Alur and Taminhal sites. A small remnant of the implementiferous gravel-bed is visible on the river bank near Chik Mulangi, which might as well be included in this group.

II. Sites where implement-bearing gravel occurs as a spread, in the bed of the river or a nullah, probably exposed through the removal of the overlying deposits. Such sites are more common and have yielded the largest number of tools. Sasive Halla, Khyad, Maneri, and Megur-Asoti (Menasgi) belong to this group.

III. A third division may be made, where stray specimens of tools are found in the bed or on the banks of the river and of its tributaries. These artefacts perhaps belong to sites lying in the upper course, from where they have possibly drifted down by water-action. Cholachgud, Dhank-Sirur, Budhihal, Kallapur, Katral, etc. are of this type.

I. SITES WHERE GRAVEL-BED IS UNDISTURBED.

1. Hire Mulangi

(a) Hand-axes

(i) rolled	803 (end-flake, sub-triangular), 804, 805 (end-flake, pear-shaped).
(ii) unrolled	801 (pear-shaped), 802 (almond).

(b) Cleavers

(i) rolled	806 (end-flake).
(ii) slightly rolled	807, 809 (end-flake).
(iii) unrolled	808 (end-flake).

2. Chik-Mulangi

(a) Hand-axes

(i) rolled	797 (end-flake, triangular), 774, 777 (pear-shaped), 779, (side-flake, triangular), 781, 791 (pebble core).
(ii) slightly rolled	780, 787 (pear-shaped), 798 (sub-triangular).

(b) Cleavers

(i) rolled	796 (end-flake).
(ii) slightly rolled	784 (end-flake), 799.
(iii) unrolled	783 (end-flake).
(c) Core-Scrapers	790, 791 (side-scraper), 794.
(d) Choppers	much rolled 785.
(e) Discoids	795.
(f) Cores	Somewhat worn: 773, 778, 786, 789, 793.
(g) Flakes	775, 776, 782, 788, 792.

The following observations could be made from a study of the above collection:—

The proportion of rolled and weathered or worn specimens is considerable at these sites. The majority of hand-axes are made on end-flakes which show a prominent bulb of percussion and a plain striking-platform, the angle between the latter and the primary flake surface being 90° or more. They are flaked mostly on the front only. Pear-shaped and almond forms are the common sub-types on flakes, and a few are pebble-core-hand-axes. Cleavers are few but carefully worked, mostly on end-flakes. Discoids and choppers are made on pebbles. Two flakes (775 and 776) show a wide-angled striking platform and a bulb of percussion, while Nos. 782 and 792 appear much worked and are cleaver-like.

3. ALUR (TALAKVAD)

(a) Hand-axes

(i) rolled	On end-flakes: 763, 768 (pear-shaped), 770 (double-pointed ovate), 771 (sub-triangular) on side-flake: 751 (pear-shaped).
(ii) slightly rolled	758 (sub-triangular), 764 (side-flake, almond-like).
(iii) unrolled	756 (perfect ovate) core-tool(?).

(b) Cleavers

(i) slightly rolled	757 (side-flake).
(ii) unrolled	769, 761 (end-flake).
(c) Core-scrapers	little rolled—760.
(d) Doscoids	
(i) rolled	754, 759.
(e) Cores	753.
(f) Flakes	749, 750, 752, 755, 762, 765, 766, 767.

Among finished tools, hand-axes made on end-flakes and having pear-shaped forms are more common, and also are weathered and rolled. In this respect they are similar to Mulangi hand-axes on end-flakes. On the other hand, well-worked bifaces like ovates and almonds show an addition to the Mulangi types. Cleavers are on end-flakes as well as on side-flakes.

Side-scraper No. 760 is an interesting specimen. It looks like a pebble-wedge or a big lunate. Discoids are circular in outline and thick in the centre. Flake 765 shows a prominent bulb of percussion with a 90° angle between the plain striking-platform and the primary flake surface. It has a keeled upper surface (mid-ridge formed by the meeting of the two cleavage planes of the quartzite block); 749 has a cordiform shape, with a flat under-surface, and Nos. 750 and 766 can be regarded as unfinished hand-axes.

4. MANERI (SW)

Only one hand-axe, No. 718, was obtained from the gravel bed in the cliff south-west of the Maneri village. It is a rolled specimen made on an end-flake with a tortoise-like shape.

5. TAMINHAL

(a) Hand-axes

(i) slightly rolled	719
(ii) unrolled	243 (almond-shaped on flake).

(b) Cleavers

(i) slightly rolled	247.
(ii) unrolled	245, 248.

(c) Choppers

(i) little rolled	249.
(d) Cores	244, 720.
(e) Flakes	246, 250, 260, 270.

The specimens from this site appear more fresh and less rolled than those from the sites described above. No. 243 is a large hand-axe fully flaked, having an almond shape and a thin tongue-like projecting point with a symmetrical bi-convex cross section. No. 719 is a short hand-axe made on a longish spheroidal lump of quartzite (not a pebble). It is of a cruder type and was found a foot below No. 243. Cleavers are oblique-edged and worked on end-and side-flakes. No. 270 is a flake from a pebble, with a convex striking platform and a sharp keel on the front, with under-surface unworked. No. 246 is much flaked and is rectangular in outline.

6. HOLE-ALUR

(a) Hand-axes

(i) much rolled	4 (pointed pear-shaped on side-flake).
(ii) slightly rolled	17 (ovate)
(iii) unrolled	2 (rostroid in form)
(b) Cleavers	
(i) rolled	5 (end-flake).
(c) Scrapers	15.
(d) Choppers	2A, 14 (little rolled).
(e) Discoids	10.
(f) Flakes	1, 3, 6, 8, 9, 13, 16, 18.

This site on the Malaprabha river was visited first. The finished tools obtained here are very few in number, the flakes making a major bulk, but all of them were removed from the "in situ" gravel. No. 2 hand-axe has a rostroid appearance and is unrolled. No. 4 is on a side-flake and is rolled. Its upper surface shows a sinuous mid-ridge, the primary flake-surface being flat and unworked. On the other hand, No. 17 has well-worked faces and is oval in form. Cleaver No. 5 is a rolled specimen having an angular butt and an oblique cutting edge. No. 2A, a chopper, is on a pebble, half flaked alternately round the periphery. In No. 14 (chopper), the flake-scars are more regular and it shows a tendency towards a scraper. Nos. 13, 6, 8 are flakes, one face of which shows a prominent bulb of percussion while the upper-surface carries a few flake-scars. No. 13 is triangular in outline and has a wide-angled (128°) striking platform. The rest of the flakes (about 6) have no definite shape or indicate any special technique.

II. SITES WITH DISTURBED (?) GRAVEL

1. Megur-Asoti (or Menasgi)

(a) Hand-axes

(i) rolled	27 (side-flake, elongated oval), 61 (ovate), 58 (almond).
(ii) slightly rolled	
side flake	Oval—66, 19, 30.
	chisel-edged—44, 138.
	burin type—140.
end flake	almond—122.
	pear-shaped—46.
	chisel-edged—41.

non-descript flakes	oval—588, 84, 179.
	almond—62, 63, 161.
	cordiform—28, 90.
	chisel-edged—43.
	pear-shaped—26, 49.
core-pebble	239.
(iii) unrolled	
side-flake	chisel-edged—139.
	almond—35.
	burin type—155.
end-flake	pear-shaped—22, 38.
	almond—54.
	cordiform—59.
	elongated oval—158.
non-descript flakes	triangular—25, 40, 65, 435.
	ovate—130.
	pear-shaped—21, 37, 39, 174, 183, 32, 201.
	almond—42, 52, 47, 57.
	cordiform—103.
core-pebble	55, 48, 45, 23, 221.
(b) Cleavers	
(i) rolled	
end-flakes	188, 67, 125, 107, 87, 81.
side-flakes	181, 144, 182, 85.
(ii) slightly rolled	
end-flakes	148, 88, 94, 168.
side-flakes	71.
(iii) unrolled	
end-flakes	163, 124, 75, 146, 72, 76, 69, 128, 132, 78.
side-flakes	74, 73.
non-descript	77, 79, 152.
(c) Scrapers	
(i) little rolled	218, 229, 233, 102, 239, 217, 213, 204, 235.
(d) Discoids	
(i) rolled	104.
(ii) rest	92, 100, 195, 98, 93, 193, 48.
(e) Cores	166, 214, 175, 192, 227, 206, 166, 232, 215, 214, 224, 175, 192, 208, 241, 211, 203, 202, 194, 220, 178.

(f) Flakes
(i) 164, 165, 159, 142, 153.
(ii) 114, 171, 137, 60, 49, 121, 177, 145, 167, 109, 53, 141.
(iii) 96, 163, 115, 106, 189, 119, 135, 133, 116, 134, 226, 120, 136, 117.

(The tool-bearing gravel at this as well as at similar sites is apparently in a disturbed condition. Therefore, while studying the tools from these sites, the stratigraphy of the river deposits, would be of no help. The physical conditions, such as the degree of rolling, weathering, etc., of the tools and their typological characteristics, would then be the only way in which these industries could be compared).

Only a few specimens in this collection are rolled. But those which show signs of rolling cannot be regarded as older, because in the rolled tools we get both cruder and finer varieties. Typologically, the entire collection appears to be a mixture of 'superior' and 'inferior' implements.

In hand-axes, oval, pear-shaped, and almond forms on flakes are more common, and practically all of them show 'free' and 'step' flaking. Cleavers on end-flakes with an oblique cutting edge are predominant. Their number is about half of the hand-axes, but the proportion of rolled specimens is greater in cleavers than in hand-axes. Among the pebble-core tools, discoids and cores form a considerable proportion. These seem to have been used as secondary tools for further flaking of the primary flakes into finished specimens. Compared with Khyad (hand-axes and cleavers), the ratio of rolled to unrolled specimens is greater in Megur-Asoti (Khyad—1 : 7 and MNI—1 : 4·5). In other respects, such as the number of tools and their variety, they are almost identical with Khyad.

Many flakes show primary flake surfaces with a bulb of percussion. No. 164 has two positive bulbs, one on each face, without any signs of further flaking. It looks like a wedge.

2. Khyad

(a) Hand-axes

i. rolled

pebble-core : 601, 507, 347, 356
side-flake : pear-shaped—274, 276, 277, 335.
chisel-edged—559
end-flakes : almond—320, 366
ovates—626, 310
chisel-edged—332

non-descript : pear-shaped—281
almond—381
ovates—339, 292 (elongated)
cordiform—302.

ii. slightly rolled

pebble-core : 518, 515, 355, 325.

side-flake : pear-shaped—337
oval—288.
U-shaped—310, 328
and chisel-edged.

end-flakes : ovates—342
chisel-edged—587

nondescript : elongated oval—295, 376, 289, 338, 468, 360, 378.
chisel-edged—478, 430.
pear-shaped—283, 282, 285, 599.
ovates—541, 346, 298, 286, 316.
almonds—305, 349, 851, 485, 336.
cordiform—311.

iii. unrolled

pebble-core : 351, 377

side-flakes : triangular—350
chisel-edged—362
ovates—309
almond—343

end-flakes : almond—367
ovate—321, 297
pear-shaped—424

nondescript : triangular—642, 568, 357, 435.
flakes
oval (elongated)—273, 352, 379, 370, 297, 348, 312, 287, 307, 671, 616, 278, 478, 303, 363.
chisel-edged—327
pear-shaped—271, 275, 482, 344, 299, 330, 272, 334, 334, 527, 380.
almond—296, 361, 249, 318, 672, 334, 673, 641.
oval—341, 245, 217, 571, 319, 300, 308, 306, 311, 315, 353.
cordiform—331, 643, 313.

(b) Cleavers

i. rolled

end-flakes : 561, 566, 447, 396, 615, 386, 465, 395, 402, 428, 400, 462, 445, 453, 475, 432, 426, 556, 398, 436, 407, 632, 307, 562.

side-flakes : 594, 408.

non-descript : 413, 444, 415, 399, 434, 452, 424.

ii. slightly rolled

end-flakes : 552, 449, 393, 385, 431, 442, 404, 455, 588, 643, 471, 440, 456, 454, 339, 391, 464, 458,, 387, 508, 359, 340, 403, 450, 427, 439.

side-flakes : 423, 554, 644, 563, 557, 467, 597, 476, 448, 598.

non-descript : 641, 401, 406, 429, 412, 480, 620, 435.

iii. unrolled

end-flakes : 419, 470, 438, 416, 852, 437, 405, 433, 384, 466, 553, 420, 509, 421, 414, 446, 460, 472, 576, 459, 390, 549, 474, 425, 602.

side-flakes : 618, 473, 502.

non-descript : 417, 620, 388, 477, 451, 580, 392, 418, 422, 443, 411.

(c) Scrapers

rolled : 538, 596.

the remaining are little rolled or unrolled. 623, 540, 611, 596, 538, 529, 533, 537, 93.

(d) Choppers

rolled : 546, 544.

the rest are : little rolled or unrolled. 353, 530, 548, 523, 529, 344, 528, 524.

(e) Discoids

rolled : 535, 484, 495, 489.

rest : 593, 574, 490, 482, 481, 500, 617, 540, 486, 494, 492, 487, 488, 579, 531, 543, 582, 538, 434, 597, 307, 483.

(f) Cores : 517, 530, 578, 519, 273.

(g) Flakes : 51 specimens.

The largest number of tools are obtained from this site, but, as at the previous (MNI) site, all of them are from the surface gravel. The collection again shows a mixture of the finer and the cruder types of tools. Even in the rolled or slightly rolled specimens, this characteristic is observed, and thus the distinction of implements into different phases from their physical conditions becomes almost impossible. The proportion of fresh specimens is undoubtedly in excess over the rolled tools, and therefore it appears that the implements, though uncovered by the removal of overlying deposits, have not been moved much from the original position where they were first buried along with the gravel.

In hand-axes as well as in cleavers, all the main-and sub-types are represented; in fact, nowhere in the Malaprabha basin so far surveyed, is such a variety of tools observed. It must be noted, however, that the implements from this site are, in general, much more refined in technique than those from Mulangi and Alur (Talakvad) upstream.

Flake-tools are most common, although the pebble-core tools are not altogether absent. But, even in the latter variety, the workmanship is not so crude that they must be regarded as primitive type of tools. A curious combination of large and deep flake-scars along with finer flat scar-beds is noticed on a good many specimens. In many artefacts it is possible to know the type of primary flakes used in their manufacture. Many of them (primary flakes) have a wide-angled striking platform with a prominent bulb of percussion. In general, tools made on end-flakes are more symmetrical in form, and in cleavers they are of a better variety. The cleaver-edges in many specimens are abraded, possibly during their use as cutting tools, as these edges are also weathered to the same extent as the remaining portion of the tools.

In pebble-tools special mention should be made of the discoids. They are in large number, but they do not seem to have any use either for digging or cuttting. Practically all of them are circular in outline. One set shows fine flake-scars and flat disc-shaped forms, and others are thick in the centre and possess a wavy edge around due to alternate bold flaking. Perhaps, these specimens might have been used as tools (or fabricators) for taking out small flakes in the secondary working or for retouching operations on the finished tools. The tools classed as "cores" might also have served the same purpose, as none of them is large enough to yield a flake for making a finished tool nor shows signs of a negative bulb of percussion.

A large number of flakes were recovered from the Khyad gravel. These vary in size and, wherever it is possible to observe, the striking platform makes a wide angle with the primary flake surface. Flakes having

faceted platforms—a characteristic of the Levalloisan technique—are extremely rare in this collection. These flakes also contain many specimens which are only partly worked and appear like unfinished tools.

3. Maneri

(a) Hand-axes :
- (i) rolled : almond—714
  pointed pearshaped—718 (end-flake), 708 (side-flake).
- (ii) slightly rolled : ovates—711, 712 (truncated)
  almond—709
  triangular—713
- (iii) unrolled : almond—710 (end-flake)

(b) Scrapers : side-scraper on flake—717.

Maneri does not show any special characteristic. The tools here are few, and though cleavers are not totally absent, their proportion is small. No. 718 is a hand-axe on an end-flake found "in situ" in the cliff south-west of Maneri village. It is somewhat rolled and shows a keeled front and an unworked undersurface.

4. Sasive Halla

(a) Hand-axes :
- (i) rolled : almond—703
- (ii) slightly rolled : core-tool—704
- (iii) unrolled : pear-shaped—700, 701

(b) Scraper : side-scraper on flake—706

(c) Discoid : 705

The condition in which the tools are available in the Sasive Halla is the same as in Megur-Asoti on the Benni-Halla, but the former contains a very small number of implements. Hand-axes are prominent, out of which No. 700 (Pl. III) is a very beautiful specimen. Both of its surfaces are smooth owing to fine flaking, the shape is pointed-almond or pear-shaped with a tongue-like projecting point and a lenticular cross-section.

III. Sites possessing stray specimens

1. Cholachgud :

(a) Hand-axes :
- (i) rolled : chisel-edged—699

2. Dhank-Sirur :
    - (a) Hand-axes :
        - (i) rolled : pointed pear-shaped—721-A
        - (ii) slightly rolled : pointed pear-shaped—721

3. Katral
    - (a) Hand-axes :
        - (i) much rolled : almond—723, 724 (end-flake)
    - (b) Cleavers :
        - (i) rolled : end-flakes—725-x
    - (c) Discoids :
        - (i) unrolled : 726

4. Budhihal :
    - (a) Hand-axes :
        - (i) rolled : truncated ovate—734; hand-axe-cum-side-scrapers—736, 737, 738.
        - (ii) slightly rolled : ovate—732
        - (iii) unrolled : pointed pear-shaped—733. almond—731; double-pointed elongated oval—735 (side-flake).
    - (b) Cleavers :
        - (i) unrolled : 739 (end-flake)
    - (c) Flakes : 740, 741.

5. Kallapur :
    - (a) Hand-axes
        - (i) rolled : triangular—744; elongated oval—743
        - (ii) slightly rolled : ovate—745 (side-flake)
    - (b) Discoids : 747, 748

6. Hirur :
    - (a) Hand-axes :
        - (i) little rolled : pointed pear-shaped—810 (end-flake)
    - (b) Flake : 855

7. Chik-Halla :
    - (a) Flake 854

8. Malaprabha gorge :
    - (a) Chopper 826

In this group, Budhihal, Kallapur and Katral have yielded a fair number of tools. The first two lie below the stratified site Alur (Talakvad) on the Malaprabha river. The tool types and their physical conditions do not differ markedly from those of Alur (Talakvad) and, like the latter, among finished tools, hand-axes are more than the cleavers.

At Dhank-Sirur and Cholachgud, 2-3 rolled hand-axes were found, and judged from their types, they seem, in all probability, to have drifted down from the Khyad site.

The Katral site is in the uppermost part of the river surveyed so far. The specimens are few, and practically all of them are rolled. The flake-scars are large and indicate bold flaking.

Hirur and the adjoining Chik-halla have not contributed many tools, but the presence of a hand-axe, No. 810, a flake, No. 855, with positive bulbs on both faces, and a triangular flake, No. 854, are sufficient to indicate the existence of palaeolithic man in that locality.

From the hill adjacent to the Manoli-gorge, a few pieces of quartzite were collected from the quarry pits, out of which No. 826 is a large-sized specimen that might have served as a chopper. The rest are flakes.

9. Tallur:

(a) Hand-axes:

(i) very much rolled, pointed pear-shaped—722; almond—727.

(b) Discoids

(i) rolled: 728

10. Navalgund-Benni-halla:

(i) rolled: 730 (hand-axe-cum-side-scraper)

Tallur and the next site on Benni-halla near Navalgund are the only sites which are further away from the banks of the Malaprabha river. Two hand-axes and a discoid from Tallur are very rolled specimens, so much so that only faint outlines of the scar-beds that have survived show the tool characteristic of these quartzite pieces. NGD-730 is made out of pegmatite rock and is very crude in technique, the alternate flaking on the side perhaps indicating the work of man.

SECTION VI

MALAPRABHA PALAEOLITHIC CULTURE IN RELATION TO SIMILAR CULTURES IN INDIA

1. *South India* [1]

(i) Nellore District

A very good account of the palaeolithic industry of the Nellore District is given by Aiyappan[2] in a memoir on "the Manley collection of Stone Age tools." The finds described in his report are mainly surface collections—from the fields, in the beds of the streams, or at the foot of hills. A few are "in situ" specimens recovered from clay (sites, A, F, G, H, 29) and laterite (sites B,$^{-1}$ T, U). The sections commonly show sandy clays at the top with a few nodules of laterite, consolidated laterite in the middle, and white clay at the bottom. It is difficult to correlate these sections with any on the Malaprabha river. However, the whitish clay at the bottom is significant. The laterite—consolidated or loose—occurring above it is the implementiferous zone. It is difficult to say whether the lateritic phase of this region has any relation with the gravels of the Malaprabha river.

Main features of the industry

1. Pebble tools are insignificant.
2. Hand-axes are most predominant; mostly on flakes, a few are on cores.
3. The majority of the tools are unrolled or slightly rolled.
4. Typologically comparable with the Stellenbosch (Acheulean) industry of S. Africa.

Comparison.

Hand-axes[3] : G_2 is comparable to *KD*-325 (pebble-butted).
A_1 is similar to *SH*-700 (finely flaked hand-axe).
$H^2{}_3$ comparable to small almonds or cordiforms from the Malaprabha river.

1. See Map (Fig. 1),
2. Aiyappan, *The Manley Collection of Stone Age Tools, MASI,* No. 68, 1942.
3. *Ibid.,* Plate II.

Cleavers[4] : D similar to *KD*-401 or 641 (convex or rounded butt, sides parallel and oblique edge).

Compared with the Malaprabha collection, the Nellore specimens contain a smaller number of refined or well-worked tools and show less variety in sub-types.

(ii) MADRAS

A general section 5 of the laterite peneplain T_0 shows shale at the bottom over which rest, in succession, white bouldery conglomerate, main detrital laterite, weathered and rewashed layer of laterite and alluvium at the top. Each of these layers also indicates approximate cultural horizons. Thus, Abbevillian belongs to boulder conglomerate and Acheul to two laterite layers above it. Four Pleistocene Terraces are distinguished in the valley of the Kortalayer,[6] and each of these terraces corresponds to a certain palaeolithic industry, and the whole succession of them further shows the cultural progress of prehistoric man. Such is not the case with the Malaprabha region, as the evidence so far collected has not revealed any terrace formation in it, nor is it possible here to work out specifically the gradual cultural changes, as its industries are in mixed condition.

TYPOLOGICAL COMPARISON

Three groups of the Madras industry can be distinguished as follows :[7]

Group I : (a) Early—deep whitish crust—Abbevillian type of hand-axes.
(b) Late—less heavily patinated—Earliest Acheulean.

Group II : Laterized specimens—Middle Acheulean.

Group III : Less patinated and unpatinated tools. Late Acheulean.

Almost all the tool-types of the Madras area,[8] even their sub-types, are found in our collection as well, viz. Hand-axes : ovate, disc, pearshaped, tongue-shaped, limande, cordates and triangular. Cleavers : all forms, as illustrated in outlines. Cores : discoidal and elongated. Side-scrapers and flakes.

The Madras industry is thus extra-ordinarily similar to the Karnatak industry, particularly so in its groups II and III.

4. *Ibid.*, Plate III.
5. KRISHNASWAMI, "Stone Age India", *Ancient India*, No. 3, p. 63, 1947.
6. *Ibid.*, p. 66.
7. De TERRA and PATERSON, *Studies on the Ice Age in India*, p. 330.
8. KRISHNASWAMI, "Changes of Prehistoric Man near Madras", *Jour. Madras Geogr. Association*, p. 72, 1938.

It may, therefore, be provisionally stated that the Malaprabha industry belongs to the Acheulean complex or the mixed Acheulean industry, with a high proportion of tools showing Upper Acheulean tendencies.

COMPARISON[9]

No. 1. Rectangular clever is similar to *MNI*-151 (on side flake).

No. 3. Triangular cleaver comparable with *KD*-422 (on side flake) and *KD*-901.

No. 2. Cleaver with pointed butt and sides somewhat parallel—similar to *MNI*-144 (on side flake) and *ATD*-757.

HAND-AXES[10]

No. 1. Pointed almond—*KD*-909 or *TML*-243.

No. 3. Pebble butted hand-axe-*KD*-284.

No. 1. Ovoid hand-axe is similar to *KD*-908.

No. 2. Cordiform comparable with *KD*-907 or *MNI*-59.

No. 1. Victoria West type hand-axe—*MNI*-197.

The discoids have many parallels in the Malaprabha collection.

2. *Godavari River*

During the recent excavations for the dam on the Godavari river at Gangawadi near Nasik, a few palaeolithic tools were obtained by SANKALIA, the detailed account of which was recently published.[11] The collection contains hand-axes, cleavers, discoids, flakes, etc., mainly on flakes[12] from the Deccan Trap (Basalt) rock. The tools are weathered and slightly rolled.

In the trenches, the stratigraphy from the bottom upward was, successively, rock, conglomerate, fissured clay, and black soil. The total

9. *Ibid., Plate* 1, p. 77.

10. *Ibid., Plates* 1, 2, and 3, pp. 79-80.

11. SANKALIA, *The Godavari Palaeolithic Industry, Deccan College Monograph Series,* No. 10. While this was passing through the press I had occasion to visit the Pravara basin at Nevasa (Dist. Ahmadnagar) where an identical industry in trap was found by SANKALIA in the lowest pebble gravel. The industry continues through the Upper gravel beds. At the junction of the latter with the overlying brownish sandy silt was found a large and fine hand-axe. This is comparable to the one from Taminhal, while the cleavers are identical in shape and type with those from Nasik and the Malaprabha basin. Animal fossils have also been found here. It is therefore expected that these will help to date the Stone Age Industries more precisely.

12. *Ibid.,* p. 7.

height of the section was 62 ft. and 6 inches. The conglomerate yielded tools "in situ". The fissured clay is brown and slightly coarse in the lower horizons, and thus it approximates the brown sandy deposit of the Malaprabha region under description.

The following specimens show close resemblance to the tools from the Malaprabha river.

38/DCM/833[13]- Cleaver—on side-flake, flat-topped, squared butt; one side straight and the other curved; oblique cutting edge abraded. Undersurface shows a prominent bulb of percussion and is unworked—similar to MNI-74.

28/DCM/759- Cleaver comparable with KD-477 (the Nasik specimen is smaller in size).

36/DCM/822- Chisel-edged hand-axe on side-flake. Comparable with MNI-44.

13/DCM/755- U-shaped cleaver similar to KD-478.

A preponderance of flake tools is the most common characteristic of this and the Malaprabha industry, though both differ in the material.

SANKALIA remarks: "A comparative study of the cleavers (from the Godavari river collection) indicates an advanced or Late Abbevellian-Acheulean age for the Godavari Industry. And, on its typological similarity to that of the Narbada, it may be placed in the Middle or the Upper Pleistocene."[14]

3. *Gujarat.*

(i) SABARMATI RIVER[15]

A typical section on the Sabarmati river at Pedhamli has the following composition:—[16] From the surface downward—yellow silt (30 ft.), pale silt (10 ft.)? (implementiferous), gravel conglomerate (8 ft. implementiferous), laterite capping (5-6 ft.), shale (10 ft.), sand-stone. (Total about 70 ft. above the present river bed). On the same river at New Hadol Nala,[17] it consists

13. *Ibid.*, Fig. 48 (8, 10, 6).

14. *Ibid.*, p. 17.

15. SANKALIA, *Investigations into Prehistoric Archaeology of Gujarat, Memoir* No. *IV, SPMRG,* 1946.

See also ZEUNER, *Stone Age and Pleistocene Chronology in Gujarat, DCMS,* No. 6, 1950.

16. SANKALIA, *ibid.*, Fig. 4.

17. *Ibid.*, Fig. 5.

of yellow silt (18 ft.), alluvium (7-8 ft.), kankary reddish alluvium with quartzite pebbles (20 ft. implementiferous), disintegrated granite (15 ft.). Total height 60 ft. Near Hirpura[18] and the Goghadwa Nala, the tool-bearing gravel is underlain by clay (mottled clay).

From these observations a close similarity, at least in the lower strata of the river deposits, is apparent between this and the Malaprabha basin. The sections on the Sabarmati are too high (varying from 60 to 100 ft.) as compared with those on the Malaprabha river, though in the former the bulk is made up of topmost wind-borne deposits.

PALAEOLITHIC INDUSTRIES.

SANKALIA has summarized the chief features of the Gujarat industry as follows:[19]

At Hadol the finds were made:—

(i) at the junction of gravel and granite.
(ii) in the gravel conglomerate.
(iii) on the granite or gravel surface (exposed).

The tools—ovate and sub-triangular hand-axes, cleavers and discoids, pebble tools and flakes—were all of quartzite, some rolled and the rest fresh. They were divisible into—

(a) tools with irregular outline, rough 'step' flaking, and pebble cortex at the butt-end, or over part of both the surfaces.

(b) tools with regular outline, wavy edge, comparatively smooth 'step' flaking, and no pebble cortex or cortex patch at a definite place.

This "inferior" and "superior" workmanship in finds did not correspond with the various strata in which they were found, but was noticed in a mixed state even in the lowest stratum.

The same is true of Pedhamli, the richest site on this river.

Almost all types of hand-axes (oval, ovate, pear-shaped, tortoise-shaped, almonds) and cleavers of the Gujarat industry are represented in the Malaprabha river collection, but in the latter the number of flake-tools is larger than that of pebble and core tools. It is only in such flake-tools that a close affinity is observed. Even in the flake-tools, primary

18. *Ibid.*, Fig. 2; see also ZEUNER, *op. cit.*, Figs. 4 and 7.
19. SANKALIA, *op. cit.*, pp. 101-102.

flakes are taken from the pebbles in the Sabarmati specimens, while these are mainly from the quartzite blocks in the Karnatak palaeoliths.

COMPARISON[20]

Ovate (25)—equivalent to KD-626, 310; BDL-738.

Pointed sub-triangular (P. 52) has many parallels.

Cleaver (P. 58)—Oblique cutting edge—is similar to KD-416.

P. 201—corresponds to triangular hand-axes of Karnatak.

P. 224—similar to cleavers with short edge (chisel-edged) KD-307.

P. 74—KD-248; P-226 (a)—hand-axe—SH-700.

Flake P-182—flake-type b (ii) with bulb of percussion on one face.

Discoids—P-170 and P-173—similar to MNI-170.

Almond-shaped hand-axe P-69 can be compared with hand-axes KD-324, 673.

(ii) MAHI RIVER

The stratigraphy of the Mahi river[21] is practically the same as that of the Sabarmati. Its palaeolithic collection from various localities, as in the Sabarmati, shows a considerable proportion of pebble-tools. The implements on flakes, viz.[22] ovate (No. 6), hand-axe (No. 11 on quartz) and a few pebble tools (chopper, No. 5, hand-axe on quartz pebble No. 10), can well be compared with similar specimens from the Malaprabha.

(iii) ORSANG RIVER

On the Orsang river,[23] a tributary of the Narbada in Central Gujarat, the cliff sections consist of top black soil (8 ft), sand (5 ft.), wind-borne silt (12 ft.), ferruginous gravel (implementiferous—4 ft.) and gravel (20 ft.). The gravel bed here is lateritized, as also the underlying sand. SANKALIA remarks: "Unlike the Sabarmati specimens, many of the finds (palaeoliths) are rolled and others water-worn, very few are sharp and fresh." Ovates, pear-shaped hand-axes and other types are similar to the Malaprabha collection. The absence of cleavers in the Orsang specimens appears to be peculiar. "As in the Sabarmati, the old Orsang gravel bed has given a mixed type of

20. *Ibid.*, see plates VI (25), VII (P. 52), VIII (P. 58), VII (P. 201), VIII (P. 224, P. 7, P. 266-a), IX (P. 182, P. 170, P. 173), X (P. 69).

21. ZEUNER, *op. cit.*, pp. 26-27.

Also SUBBA RAO, "Archaeological Explorations in the Mahi Valley", *JMSU*, Baroda, Vol. I, pp. 33-69, 1952.

22. SUBBA RAO, *op. cit.*, Plate VI.

23. SANKALIA, *op. cit.*, Fig. 7.

industry, crude and fine, comprising hand-axes, choppers, discoids, and flakes."[24]

COMPARISONS.

No. 297—Small ovate hand-axe; smooth flat under-surface, uneven upper-surface, with trace of a deep flake-scar on one side—similar to *MRI*-711.

No. 295—pointed ovate (or almond)—equivalent to *KD*-324, 673.

4. NARBADA RIVER.

A detailed study of the Pleistocene deposits of a part of the Narbada river was carried out by De TERRA and PATERSON near Hoshangabad and Narasingapur.[25] They recorded two gravel beds, lower and upper, separated from each other by a layer of pink clay and/or sands. No clear terraces were observed at that time, but on archaeological grounds the deposits were correlated with those of North-West India as under:

Lower Group: (Age—Terraces 1 and 2 of Potwar-Punjab). Industries: large flakes with prominent bulbs (Pre-Soan industry) in addition to Abbevillian-Acheulean hand-axes, cleavers, cores and flakes of Early Soan type, most of them heavily rolled.

Upper Group: (Age—Terraces 3 and 4 of Potwar-Punjab). Mid-Pleistocene fauna. The biface industry is Acheulean and rolled, typologically falling within the range of the Late Soan industry.

A complete section of river deposits from bottom upwards shows the following order:[26]

1. Laterite
2. Conglomerate (lower gravel)
3. Red concretionary clay
4. Upper gravel and sand
5. Pink concretionary clay
6. Basal gravel of cotton soil
7. Black cotton soil.

24. *Ibid.*, p. 48.

25. De TERRA and PATERSON, *Studies on the Ice Age in India and Associated Human Cultures*, p. 313-326, 1939. KRISHNASWAMI, "Stone Age India," *Ancient India*, No. 3, 1947.

26. De TERRA and PATERSON, *op. cit.*, pp. 314, 322.

The average height of cliffs, which have exposed these deposits, varies approximately from 50 to 70 ft. above the water level.

The author visited the Hoshangabad sites in January 1953 and observed these deposits from Ghoda Pir Ghat up to the railway bridge downstream on both the banks of the river. Except the lowermost lateritic deposit, all are ideally exposed just below the railway bridge. Here the lower gravel rests directly on the quartzite, which has NW-SE strike and a SSW dip of 32°.

A few yards upstream from the Shetani or Main Bathing Ghat, the lower gravel conglomerate is exposed in the form of a platform measuring approximately half a furlong in length, 350 to 400 ft. in breadth, and 5 to 6 ft. thick. The formation here is purple or pink-coloured Vindhyan sandstone, with a NW-SE strike and a SW dip of about 15° - 20°.

During the archaeological investigations[27] carried out recently on this river at Maheshwar, a part of the river was examined betwen Mandaleshwar and the Sahasradhara Falls for a distance of 10 miles. Both the lower and upper gravels, together with their associated clays, sands, etc., were observed in this part also. But in this area the upper gravel is well exposed while the lower gravel is visible only at two or three places above the water level. In these sections the clay lying below the upper gravel is whitish, hard and in many places extremely sandy, against a pinkish or reddish one occurring near Hoshangabad. The topmost black-cotton-soil and the lateritic deposit below the lower gravel are not represented in the Maheshwar-Mandaleshwar localities. The lower gravel, in general, is very coarse and firmly cemented; the upper gravel, on the other hand, contains big pebbles, small gravel and sand, and is comparatively loose. The sand is invariably calcareous and well-cemented, and often large blocks of it are found on the surface, concealing the underlying gravels and clays. The disconformity between the clay and gravel of the upper and lower groups respectively as recorded by De Terra and Paterson at Hoshangabad, etc., is noticed in these sections also.

About 350 tools were collected during the survey, a majority of which (66%) are in much rolled condition. A larger number of tools could have

27. Joint Universities' Expedition organised by the Deccan College with help from the Universities of Poona, Bombay, and Baroda, to conduct excavations at Maheswar (Nimar District, Madhya Bharat) on the Narbada river. The author participated in its river valley survey in January, 1953.

been picked up but in many implements the rolling has practically removed their tool character, and, therefore, such specimens were rejected. The artefacts, in general, are made on thick flakes taken from the boulders and large water-worn pebbles but the proportion of the latter is extremely low.

A high percentage of scraper-like-choppers (side and end) is significant. In many specimens the primary flake surface with bulb of percussion and the striking platform is unworked. All show characteristics of the Clactonian technique of wide angle between the flake surface and the unfaceted striking platform. The hand-axes are comparatively rare and are normally well worked in the Acheulean technique. Cleavers and cleaver-like flakes are also common in this collection. Discoids are few in number. True pebble-core-tools are very rare.

The distinction between the tools collected from the lower and the upper gravels is not quite apparent, as both crude and fine varieties were obtained from each of them, though the proportion of well worked specimens is greater in the upper gravel. A fairly large number of small retouched and fresh flakes were obtained from the top of the upper gravel.

The Narbada industry is thus a mixture of chopper-chopping tools of the Soan type and bifacial tools like hand-axes, cleavers, etc. of the typical Acheulean type (ovates, almond and pear-shaped hand-axes, etc.). The Malaprabha collection has parallels among the latter set of Acheulean tools, the former being completely absent. One important characteristic of these two industries is the predominance of the tools worked on flakes with a wide-angled unfaceted striking platform. In the Narbada collection, the end-flakes are more common. On the faunal evidence, the Narbada deposits denote the Middle Pleistocene age and, therefore, if typological similarities are taken into consideration, the Malaprabha industry perhaps also belongs to the same period.

5. *Mayurbhanj*[28]

CHARACTERISTICS OF THE SITE

1. Absence of terraces.[29] The tools were collected from laterite. The lowest depth at which (Nuaberi) tools were found was 1 ft. 11 inches, and the upper depth 1 ft. below the surface of the ground.[30]

28. BOSE and SEN, *Excavations in Mayurbhanj*, 1948.
29. *Ibid.*, p. 12.
30. *Ibid.*, p. 7.

2. The excavated section is as follows:[31]
   (a) overburden of yellowish earth, mixed more and more with fragments of pisolitic laterite—23 ft.
   (b) pisolitic laterite, not very compact and mixed frequently with small, irregular fragments of quartz and a few rolled quartz fragments. Some artefacts—12 inches.
   (c) pisolitic laterite very compact, with very few quartz fragments. No artefacts —13 inches.

Only on the bank of the Sankri nullah and Kamarpal, boulder bed is underlain by a sticky clay, white-yellow in patches.

In Karnatak, the pisolitic gravel is noticed only on the hill adjoining the Manoli gorge and has yielded a few tools. The mottled clay of the Malaprabha basin can be compared with the sticky clay mentioned above.

PALAEOLITHIC INDUSTRY

(a) The industry of Kuliana is mainly a core-industry[32] with an important addition of pebbles and a small admixture of flakes with high-flaking angle and unprepared and unifaceted striking platform.

(b) Percentage of tools:[33]

Pebbles	.. 12·21 %
Core	.. 81·29 %
Flake	.. 6·48 %

(c) "Hand-axes and choppers predominate and, in the former class, ovate and oblong types are more numerous than almond forms showing better flaking technique."

(d) Types of implements:

Choppers	.. 24·28 %
Rostroids	.. 5·54 %
Hand-axes	.. 44·34 %
Cleavers	.. 13·72 %
Scrapers	.. 2·56 %
Points	.. 1·66 %
Knife	.. 6·63 %

31. *Ibid.*, p. 19.
32. *Ibid.*, p. 127.
33. *Ibid.*, p. 118.

(e) Tools resembling Clactonian forms are represented, but none are prepared in the Levalloisian way. The tools of advanced type are, on the whole, few in comparison with more primitive one.[34]

These observations point to some dissimilarity between the Malaprabha and the Mayurbhanj palaeolithic industries. The former contains a larger number of flake-tools, pebble and core tools being very subordinate, and the majority of the tools show a superior workmanship.

PROBABLE COMPARISON

KU-A-87 : completely worked over, amygdaloidal form.

or KU-A-31 : amygdaloidal biface (hand-axe) equivalent to KTL-724, KD-320, 381, MNI-57.

KU-A : pebble butt, roughly triangular form with a steep triangular cross-section in the anterior, is similar to A-2.

KU-C-3 : thick discoidal chopper—equivalent to A-2A.

KU-C-24 : amygdaloidal biface, butt thick with careless dressing. Dorsal face convex, ventral flattish; both with partial low mid-ribs, margins straight and tapering—similar to hand-axes type I (c) MNI 38, 46; KD-426, HMG-805.

6. *North-West India (Soan Valley etc.)*[35]

Systematic research in pleistocene deposits and the associated stone-age human cultures in India was first made in this region. Since then the pleistocene terrace sequence worked out there has been taken as the standard basis for correlating the other palaeolithic industries in India. But, as the Malaprabha basin is far away from the Punjab and lies outside the limits of the glaciated and periglacial zones, the stratigraphic correlation between these two distant areas is hardly possible, though it has been tried in Madras. Moreover, there are no specific data available in the form of fossils or comparable deposits, etc., for this purpose. Therefore, only typological characteristics of the tools from the Punjab and Karnatak are considered here.

Early Soan: It is much more crude and primitive than the Late Soan, and shows a flake technique coupled with the consistent use of pebble tools.

34. *Ibid.*, p. 127.

35. De TERRA and PATERSON, *op. cit.*, and MOVIOUS, H. L., *Early Man and Pleistocene Stratigraphy in Southern and Eastern Asia*, 1944.

Late Soan: Although pebble-choppers and cores are present, this phase consists in the main of flakes and blades. Almost half of the flakes have faceted platforms without any signs of retouch. This phase shows a general resemblance to the late Levalloisian of Europe.

A variety of pebble tools better worked than Early Soan. A far larger number of flake tools than in the Early Soan and corresponding cores, the flake element being distinctly Levalloisian in technique with Clacton flakes still predominant.

The Malaprabha industry does not show any resemblance to these Soan industries.

THE CHAUNTRA INDUSTRY[36]

Chauntra, with its Soan flake and pebble industries, is the only site in the Punjab which shows a development parallel to that of the Madras (hand-axe) industry of the South.

Group B: It is less worn, and the hand-axes, with their less crude flaking and more regular outline, indicate a typologic age of lower to middle Acheulean.

Group C: The fresh, unrolled specimens include some Late Acheulean hand-axes, cordate, pyriform, and pointed ovate.

Many specimens in the Karnatak collection can be compared with Group C tools from Chauntra.

36. KRISHNASWAMI, "Stone Age India", *Ancient India*, p. 26, 1947.

SECTION VII

MALAPRABHA PALAEOLITHIC CULTURE IN RELATION TO SIMILAR CULTURES OUTSIDE INDIA

1. *AFRICA*

The greatest advantage for prehistoric studies in Africa is that the various phases of the palaeolithic industries there could be correlated not only typologically but stratigraphically also. Well developed terraces, the associated sedimentary deposits, and the fossils further help in dating the finds and in comparing them with the corresponding European types or those of other regions. All these varied facilities are not yet available in India. So, a typological comparison of the prehistoric finds would be the best possible method of determining their regional characteristics.

(i) Vaal River Basin (South Africa)[1]

This region seems to have witnessed wet and arid phases of climate thrice, alternately, during the Lower Palaeolithic period. In the first wet phase, cutting of terraces I, II, and III took place. These deposits correspond to cultural phases of the palaeolithic period designated as Stellenbosch I, II, III and IV, each one showing certain characteristics in the implements. A pre-Stellenbosch industry is also found associated with the earlier arid climate. After the first wet phase, a semi-arid climate prevailed, with the deposition of calc-tufa in sands on younger gravels, which was followed in succession by a second wet phase, to which belong the tools of the Fauresmith-I stage. The Fauresmith-II corresponds to the arid or semi-arid conditions of the subsequent period. The Middle Stone-Age complex appears later on, followed by Neolithic elements. Lowe has compared the Vaal River Palaeolithic Cultures with the European contemporaries as follows:[2]

Stellenbosch-VI (or Fauresmith-II) represents the Advanced Levallois type of technique.

Stellenbosch-V (or Fauresmith-I)—Mid. Levallois and small evolved Acheul and Micoque type.

Stellenbosch-IV—Advanced Acheul type. Victoria West—II.

1. Lowe, *The Geology and Archaeology of the Vaal River Basin*, 1937.
2. *Ibid.*, p. 66.

Stellenbosch-III—Advanced Acheul type (occasionally with S-twist), Micoque and Larsen types. Victoria West—I.

Stellenbosch-II—Early to mid-Acheul types.

Stellenbosch-I—Chellean types (Abbeville technique and Clacton technique.

Pre-Stellenbosch—Pre-Chellean, Abbeville technique.

In a recent summary of the Vaal River Chronology, LOWE[3] has dropped the old terms Stellenbosch-I, II, etc. and has replaced them by the terms South African Chelles-Acheul I, II, III, etc. He has also revised the sequence of major events in the Vaal River Basin. While attempting a typological comparison between the Malaprabha and Vaal river industries, the old cultural terms are used here for the sake of convenience. Since these two regions are far removed from each other, stratigraphical correlation is out of question. The present comparative (typological) study is intended mainly to ascertain whether the Malaprabha industry also shows evolutionary stages of the Chelles-Acheul culture as observed in the Vaal river region.

PALAEOLITHIC INDUSTRIES

Stellenbosch-I:

Hand-axes (i) on cores—flaking bold and steep, but from the point rather than from the sides. KD-527 can be compared with those illustrated on Pl. X and XI.[4]

(ii) On end-flakes having a wide angle between the striking platform and the flake surface and the well marked semi-cone of percussion. No. 1 on Plate XII is similar to CMG-779, 797; HMG-803, ATD-771, KLR-744.

Cleavers No. 2 (Pl. XIV) similar to MNI-152 (side flake) and KD-852 (end-flake).

Stellenbosch-II:

Hand-axes. A superficial similarity can be immediately noticed among its three types, viz. almond-shaped, elongated ovals and ovates. But in the Malaprabha collection they are on flakes, while those in the Vaal are made on cores. See Pl. XVI (Vaal River Basin).

Cleavers. Both types of cleavers: on end- or side-flakes having invariably an obtuse angle, and an oblique or straight edge, are found in the Malaprabha industry.

3. LOWE, "The Vaal River Chronology (an up-to-date summary)", pp. 10-11, 1952.
4. LOWE, *Ibid.*, Pl. X and XI.

No. 3 (Pl. xvi) can be compared with *KD*-416, 396; *MNI*-124, *KTL*-5 (all on end-flakes).

Similarly, No. 4 (Pl. xvi) to *KD*-423, 554, 594; *MNI*-74. (all on side-flakes).

Stellenbosch-III :

There is a remarkable similarity between the Vaal and Malaprabha industries in all the tool types, hand-axes as well as cleavers. Even the so-called "Larsen type' and burins are found in the Malaprabha collection. Just as the former have relatively "heavy" bodies, at least two of our group, No. *KD*-378 and *KD*-383, being made of hornblende schist and granite respectively, are so.

Hand-axes on side-flakes[5] recall the following from the Karnatak :—

Elongated oval (*MNI*-27, *BDL*-735, *KD*-288); almonds (*MNI*-35); ovates (*MNI*-66, 19, 30; *KD*-309, 318, 315).

Types IV(b) and V(c) of the Malaprabha industry (perfect ovates and almonds) are similar to the finished specimens of the Vaal river.[6]

KD-311 and *KD*-302 (cordiforms) also have parallels in the Vaal industry.[7]

Cleavers. All the sub-types illustrated in the Vaal river report have the following parallels :—[8]

No. 1—*MNI*-151, 152, 74 (roughly rectangular but has somewhat trapezoid cross-section); *KD*-594 (oblique edge), 557, 563.

No. 2—*MNI*-77, *KD*-388.

No. 3—*KD*-422, 443, 480.

No. 4—There are cleavers of this description in the Malaprabha collection, but, since they are much flaked, it is difficult to determine whether they are on the side- or end-flakes. (All the cleavers mentioned above are on side-flakes).

Cleavers on end-flakes[9]

No. 1—roughly rectangular, with well trimmed parallel sides, *KD*-416 (trapezoid cross-section); *KD*-449 (plano-convex cross-section).

5. Lowe, *The Geology and Archaeology of the Vaal River*, Pl. VIII.
6. *Ibid.*, Pls. XVIII and XIX.
7. *Ibid.*, Pl. XX.
8. *Ibid.*, Fig. 14, p. 83.
9. *Ibid.*, p. 84, Fig. 16.

No. 2—rounded and well trimmed butt and parallel sides, *CMG*-450, *CMG*-784, *KD*-470 (trapezoid cross-sections); *KD*-588 (plano-convex cross-section).

"U"-shaped cleaver *KD*-410, beautifully worked on both faces, shows S-twist. Stratigraphically, Stellenbosch-III has this characteristic tool, but KD-410 is more refined and, therefore, rather falls under Stellenbosch-IV.

Stellenbosch-IV.

Implements of this stage contain hand-axes and cleavers on end-flakes struck from prepared cores.

Hand-axes—These are generally well worked and have lenticular cross-sections with straight or slightly curved edges and include typical almond and ovate forms.

Types IV (c. d) and V (c.d) of the Malaprabha industry can be compared with these types of hand-axes.

Cleavers—They are consistently worked on end-flakes with well prepared platforms and have rectangular outlines and rounded or roughly rounded butts. They are often well worked over both faces.

(ii) UGANDA[10]

The Kagera river valley near Nsongezi shows a series of river terraces at 270, 200, 150 and 100 ft., which have yielded artefacts from Earliest Kafuan to African Acheulean types. The Malaprabha industry can in no way be compared with that of any stages of the Kafuan Culture. The implements from M and N horizons of this river, however, can be compared with some of our specimens.

M-HORIZON OF UGANDA: Early African Acheulean.

It is "a mixture of intimately associated pebble or core and flake techniques; well made bifaced tools, mainly hand-axes on core or on flakes (usually the latter), cleavers consistently on flakes, discoidal artefacts, fabricators, scrapers on flakes——and waste products that clearly indicate a keen appreciation and mastery of well controlled flaking methods."[11] This description is quite applicable to the Malaprabha industry also.

10. O'BRIEN, *The Prehistory of Uganda*, 1939. LOWE, *The Pleistocene Geology and Prehistory of Uganda*, 1952.

11. LOWE, *op. cit.*, p. 38.

Compare :

No. 2—Hand-axe[12] on end-flake—possibly identical with KD-367, with mid-ridge and cortex on the front and unworked undersurface. Also comparable with *ATD*-768.

No. 5—Hand-axe—similar to MNI-39 or CMG-787, rhomboid cross-section and flaked on both surfaces.

A triangular cleaver with pointed butt and oblique cutting edge recalls ATD-757.

No. ATD-760 looks like a wedge similar to 3-B (pebble wedge—pl. VII) or a backed blade No. 1 (Pl. XIII) of Uganda.

O'BRIEN did not observe base-keeling on flakes in Uganda palaeoliths[13], but in our area we do have it. HMG-801, and KD-599 show this technique.

N-HORIZON OF UGANDA[14]

It is to the collection from this horizon that the Malaprabha industry shows the closest similarity. Its sub-types in hand-axes viz. (i) Pear-shaped points, (ii) ovates, ovate-acuminate, (iii) sub-triangular, (iv) cordiforms, (v) pick-like forms, recall similar types of hand-axes in our collection. Both the N-horizon and the Karnatak have a preponderance of flake tools worked by controlled flaking.

No. 1—an asymmetrically biconvex limande[15] is comparable with KD-288 (double pointed elongated oval on side-flake).

No. 2—similar to KD-906 (ovate).

No. 3—Pears-shaped biface on a pebble comparable with KD-435 (thick sub-triangular hand-axe).

No. 4—pointed almond equivalent to KD-909.

No. 5—Cordiform[16] similar to KD-907.

Cleavers: Three types of blades (cleaver edges); (i) square-bladed, (ii) guillotine-bladed, (iii) narrow chisel-bladed. Butt squared, rounded or pointed.

12. LOWE, *op. cit., Plates* IX (2), X (5), XI (triangular cleaver), XIII (1).
13. O'BRIEN, *op. cit.,* p. 121.
14. LOWE, *op. cit.,* p. 46.
15. LOWE, *op. cit.,* Pls. XIV (1), XIV (2, 3, 4).
16. LOWE, *op. cit.,* Pl. XVIIII.

No. 3—on end-flake; bevelled, rounded butt and oblique cutting edge.[17] Similar to KD-806.

Picks[18]—No. 2 is similar to KD-853.

Another feature of the Uganda culture is also worth recording. Its "many hand-axes and other tools are made on flakes that give the impression that a cleaver was intended. There are all gradations of tools (on flakes) between the hand-axes and the cleavers. So much is this the case that it is often impossible to say whether we have an acute-angled guillotine type of cleaver before us, a chisel or an incomplete hand-axe or side-chopper or scraper."[19] These blades (cleaver edges) are sometimes only 1·5″ wide.[20] This is exactly the case of the Malaprabha industry also. (See chisel-edged hand-axes—MNI-139, 138, 43, 44; CMG-699 etc., in which the average breadth of the tool is 7 to 8 cm. and the chisel-edge 3 to 4 cm. wide).

Possibly No. 5 and 6—Kombewa flake[21]—with plain positive flake surfaces approximate to MNI-164 and H-Tag-853 flakes with two positive flake surfaces.

The Uganda culture, according to O'BRIEN, dates from the Lower or Early Mid-Pleistocene, with Upper Acheulean ending with Mid-Pleistocene.[22]

(iii) *The Olduvai Gorge (East Africa)*[23]

In East Africa the Olduvai Gorge has exposed Pleistocene deposits representing five pluvial and four interpluvial or dry periods, and the whole succession, on the faunal basis, indicates the Mid-Pleistocene period. Five distinct beds can be recognized in these deposits, each one of them being associated with a certain lower palaeolithic industry. A gradual evolution in the culture is also noticed from Bed—I to Bed—V. Thus—

Bed-1: Oldowan Culture; pebble culture; commonest type-choppers.

Junction of Bed-I and Bed-II and lowest levels of Bed-II } Chelles-Acheul Culture of E. Africa evolutionary stages 1-3.

17. LOWE, *op. cit.*, Pl. XIX (3).
18. LOWE, *op. cit.*, Pl. XXV (2).
19. LOWE, *op. cit.*, p. 51.
20. O'BRIEN, *op. cit.*, p. 131.
21. LOWE, *op. cit.*, Pl. XXII.
22. O'BRIEN, *op. cit.*, p. 55.
23. LEAKY, *Olduvai Gorge* (a report on the evolution of the hand-axe culture in beds I-IV), 1951.

Bed-II : Chelles-Acheul Cultural stages 4 and 5 (the transitional stages between the Chellean and the Acheulean).
Bed-III : Chelles-Acheul Culture stages 6-8.
Bed-IV : Chelles-Acheul Culture stages 9-11.
Bed-V :

TYPOLOGICAL CHARACTERISTICS

THE OLDOWAN CULTURE

It shows absence of hand-axes and is regarded as antedating the Chelles-Acheul culture. It has been referred to as a "pebble culture", the commonest tool type being a crude chopper. Though the Malaprabha industry contains a number of choppers comparable with those illustrated on pp. 38-40,[24] there is no stratigraphic evidence for attempting a close comparison.

CHELLES-ACHEUL STAGES: 1-3

Hand-axe on pebble[25] with the upper face having a more or less defined central keel and the section roughly triangular, is similar to KD-365.

CHELLES-ACHEUL STAGES: 4 and 5

In outline and shape, the hand-axes of these stages belong to a form which might well be described under the old terminology as Acheulean. The best implements at this level (5) are all more definitely bilaterally symmetrical and with a tendency to a symmetrical biconvex section. The Malaprabha collection contains a good number of hand-axes with this description, but, unlike the Olduvai specimens which are on cores, they are on flakes.

CHELLES-ACHEUL STAGES: 6-8

Stage (7) in the evolution of the Chelles-Acheul culture is distinguished from all the previous ones by the presence of a high proportion of very large, well made hand-axes, which are in most cases much wider in proportion to their length than the more ordinary types. Cleavers have short cutting edges.[26]

In Stage 8, (i) the average size of the hand-axes and cleavers is very noticeably smaller than in stage 7. (ii) "S" twist ovates become a characteristic feature. (iii) The cleavers in most cases are V-shaped rather than U-shaped, with their widest point at the cutting edge. These details apply very well to many hand-axes and cleavers in our collection.

24. LEAKY, *op. cit.,*
25. *Ibid.,* p. 64.
26. Compare chisel-edged hand-axes from the Malaprabha collection.

Compare:[27]

almond-shaped tool: No. 66.
ovate: No. 69.
cleaver : No. 50 *KD*-474.

CHELLES-ACHEUL STAGES: 9-11

In Stage 9, the variation in the size and shape of the hand-axes is very great, possibly greater than in any other stages in the whole evolutionary sequence. Long asymmetrical but beautifully made hand-axes occur side by side with small symmetrical hand-axes only a few inches long. Cleavers are relatively common compared with those in other stages in the sequence, and the commonest form is that which is more or less U-shaped with a parallelogram section.

The implements from the Malaprabha basin possess all the main characteristics of the tools described under the Olduvai Gorge Stages 6-11, the only difference between these two regions being that, in the former, the implements are on flakes, while in the latter they are on cores. But the technique used in both of these industries is the same Acheulean technique.

2. *Java, Burma, Malaya and China*

The lower palaeolithic industry of the Malaprabha river cannot be compared with any of those from Java, Burma, Malaya and N. China,[28] as all of them belong to the chopper-chopping-hand-adze complex, which is different from a true hand-axe (a bifacial implement) culture complex of Europe, Africa, the Near East and India.

3. *Ceylon*

DERANIYAGALA[29] thinks that the earliest Ratanpura culture phase, with its crude stone-axes having no retouch, is more akin to the earlier Soan types than to the quartzite hand-axes of Madras. Like the other Asian palaeolithic sites described above, the palaeolithic industry of Ceylon also cannot be compared with the Malaprabha industry.

4. *Europe*

The European palaeolithic industries with which the Malaprabha industry is favourably comparable, are, according to the older chronology, the

27. LEAKY, *op. cit.*, pp. 122 (No. 66), 125 (No. 69), 126 (No. 50).

28. MOVIUS, *Early Man and Pleistocene Stratigraphy in South-East Asia*, pp. 93, 44, 75. 1954.

29. DERANIYAGALA, "Some Aspects of the Prehistory of Ceylon", *Spolia Zeylanica*, Vol. 23, pt. 2, 1943, p. 93—quoted by SANKALIA, *Prehistoric Archaeology of Gujarat*, p. 116, 1946.

lower palaeolithic tools grouped typologically and stratigraphically into the Chellean, the Acheulean and the Micoquian. The hand-axe is the predominant tool in all these cultures. It shows a gradual evolution from the earliest cruder types with uneven edges and pebble cortex on the butt-end and having sometimes almond-like forms towards oval shapes with more even edges together with an S-twisted variety. Finally, it develops in the late Acheulean times into a small oval, almond-shaped form. Practically all these types have parallels in the Malaprabha collection.

The characteristics of the Acheulean implements of Europe can be summarized as under:[30]

Lower Acheulean (BREUIL's I & II): core and flake industry, characterized by large, flat flakes, anvil technique and secondary flaking with bone or wood.

Middle Acheulean (BREUIL's III & IV): shows a great advance in technique. The ovates are thin and regular, often revealing an "S" twist.

Upper Acheulean (BREUIL's V & VI): differs little from the Middle Acheulean, being mainly finer and more evolved.

The Malaprabha industry is a biface industry on core and flakes, the latter being more predominant. It possesses all the Acheulean features mentioned above. In Europe, the cleaver is regarded as the type tool of the Acheulean industry.[31] This implement is very common in the Malaprabha region as well. Thus from the typological comparisons we can safely designate the Karnatak industry as an "Indian Acheulean entity."

As far as environmental factors are concerned, it is not at all possible to attempt any stratigraphical comparison with the European palaeolithic sites. Another factor—the raw material of the implements—should also be considered. In Europe flint is the most common stone used in the manufacture of tools. On the other hand, in India and, of course, in Karnatak, quartzite is the most favourite raw material, as this region has no flint deposits. Worked with the same technique, these two stones produce different results. The scar-beds are usually more concave and smooth in the case of flint, while they are somewhat rough in quartzite. In this respect the African tools are more akin to those of India, as the material—Table Mountain Sandstone and Trap—used there is very similar to ours.

30. WRIGHT, *Tools and the Man*, 1939, p. 46.
31. LEAKY, *Stone Age Africa*, 1936, pp. 44 and 182.

SECTION VIII

SUMMARY AND CONCLUSIONS

The landscape of the Malaprabha basin is, in general, of the erosional type. The river, though not completely graded on the Kaladgi formation, has developed broad and flat valley forms in the region underlain by old crystalline rocks, on which it presents a much-meandering pattern. The residual hills of quartzite in the lower course break the monotony of the otherwise peneplain topography of the southern "black cotton soil plain," their present isolation or detachment from the main ranges being due to repeated river captures throughout the geologic past since the formation of the drainage on the Kaladgis. At what stage the Pleistocene history of this landform begins, is difficult to conjecture, as there is very little evidence so far available for tracing it.

In all probability, the river does not seem to have changed its present position after the deposition of the palaeolith-bearing gravel.

The river deposits (bottom-set mottled clay and gravels, overlying brown sand, black soil and river alluvium) do not throw much light on the climatic successions of this region from the time of its occupation by prehistoric man. The unfossiliferous nature of these deposits and the absence of a terraced structure are further handicaps in the proper dating of the deposits and the associated lithic cultures.

If the texture and physical conditions of the gravel, sands, etc., denote a certain "micro-climatic" change, then, following Wayland,[1] the successive stages may be summarized as under:

Laterite (?)→mottled clay→gravel conglomerate→
More rain→less rain→ more rain→
sands→river alluvium
less rain→ (?)

By applying ZEUNER's climatic successions in Gujarat to the Karnatak region, a close parallelism between Karnatak and Gujarat as far as environmental factors are concerned is shown already.[2] But there is still a

1. WAYLAND, E. J., "The Study of Past Climates in Tropical Africa," *Proceedings of the First Pan-African Congress on Prehistory*, p. 59, 1952.

2. See Section IV.

vast region between the Malaprabha river in the south and the Sabarmati river in the north, which awaits a more detailed investigation, and, unless and until more data of this tract are forthcoming, it would be premature to pass any remarks, at this stage, about the pluvials or interpluvials of this part of Indian Peninsula.

It is worth while noting the disposition of the investigated sites at different levels above the present flood-plain. Tallur is at 2200 ft.;[3] the Malaprabha gorge site is at 2200 ft.; while the Hirehalla-Teggihal (H-Tag) is at 1950 ft., and all of them lie between the two barriers, namely, the Manoli gorge north of Saundatti and the Kolchi gorge near Ramdurg. Again, downstream from Ramdurg, the Hire Mulangi and Alur (Talakvad) sites are at 1800 ft., and here the implements come from stratified deposits. On the other hand, the sites at Khyad, Megur-Asoti, etc., are in the bed of the river itself. Whether these heights designate different terrace-levels cannot be said with certainty. The palaeolithic collection made at each of these localities is, however, very significant. For example, the tools recovered at Tallur are heavily rolled and indicate crude workmanship. A big chopper from the Manoli hill likewise shows inferior workmanship. On the other hand, the specimens from Hirehalla (Teggihal) are more refined. Such characteristics are much more apparent in the second set of sites down Ramdurg.[4] There appears to be a gradual change in the physical condition, the technique, the form and the variety of the implements collected at different sites from Hire Mulangi to Khyad and beyond Khyad. From these observations it may be tentatively concluded that this remarkable variation perhaps denotes various phases of the stone-age industry of the Malaprabha basin.

The following conclusions emerge from the typological study of the Malaprabha palaeolithic industry:

1. The implements worked on flakes taken out from the blocks of quartzite are predominant. The pebble tools and those worked on flakes from pebbles are very insignificant. Thus it is mainly a flake culture, with a little admixture of pebble-core tools. (The flake culture in the sense that the tools are made on flakes, though the technique is bifacial).

2. The majority of the tools are fresh. Those which show signs of rolling and weathering are not necessarily inferior implements, as some of the better variety have also suffered by these actions. The tools and the

3. Height above the sea-level. The flood-plain is approximately at 1900 ft.
4. See Sections II and V.

associated gravel do not seem to have been much disturbed since their deposition.

3. The implements can be classified into hand-axes, cleavers, choppers, scrapers, discoids and flakes, their proportion in the collection being approximately in the same descending order. In each group, particularly in the hand-axes and cleavers, many sub-types can be recognized.

4. Wherever it is possible to observe, the technique employed in detaching the primary flakes from cores is the "block-on-block" technique (Clacton type flakes with a wide-angled unfaceted striking platform). The secondary trimming is of the type of controlled flaking (cylinder-hammer technique) with the characteristic step-flaking, and recalls the technique that is used in the standard Acheulean tools. Though the flakes reminiscent of the typical Levallois technique are extremely rare, they are sufficient to prove that the palaeolithic man of the Malaprabha basin had knowledge of this technique also.

5. A close parallelism, in fact identity, exists between the Malaprabha industry and the industries of Madras, Godavari, and Gujarat. But it can be compared only partially with the Narbada and Mayurbhanj industries. The Soan culture of N. W. India is of the chopper-chopping type and, therefore, no comparison is possible between these and the Malaprabha tools. Some tools from Chauntra (C-Group), however, have affinity with the corresponding Karnatak specimens.

6. Outside India the comparison with the lower palaeolithic industries of Java, Burma, Malaya and China is out of question, as all of them belong to entirely different cultures, viz., the chopper-chopping-hand-adze-complex, which is absent in the Malaprabha industry.

7. A number of tools from this region can well be compared with those from the Vaal river (Stellenbosch II to VI), Uganda (N-Horizon) and Olduvai Gorge (Chelles-Acheul culture stages 5-11)—all from Africa.

8. The Malaprabha collection also possesses all the characteristic features of the standard Abbevellian-Acheulean tools from Europe.

From these observations it may be concluded that the Malaprabha palaeolithic industry is mainly Acheulean, though it does contain some tools of the Abbevellian type,[5] and belongs, most probably, to the Middle-Pleis-

5. It may be advisable to divide the Malaprabha industry into Abbevellian and Acheulean, as there are some tools which technologically appear to be of earlier type. However, since it is not possible to distinguish the industries stratigraphically, what appears as the Abbevellian type of tool may not be in fact, a tool of that industry only, but it may merely represent a stage in the making of Acheulean type of tools.

tocene period. In view of a high proportion of well-worked tools with Acheulean tendencies, it perhaps denotes an advanced or Late Acheulean age.[6]

In selecting the sites for their settlement in the Malaprabha basin, the palaeolithic men have shown remarkable wisdom. Their homes were ideally situated along the river Malaprabha and its tributaries and also along the contact of the two geological formations—Archaeans and Kaladgis. While the former provided the basic requirements of water and some amount of aquatic food, the soils formed on the varied rock formations under the influence of the most suitable climate, bore a luxuriant vegetation. The animals that roamed in the forests of that period further supplemented their food necessities. All the palaeolithic settlements seem to have been open-air sites scattered along the foot of the quartzite hills. The huge accumulation of boulders in the talus might have been used as emergency shelters or for defence against wild animals. The residual hills in this otherwise pene-plain topography which provide a commanding view for miles together, was an additional advantage of this landform. An inexhaustible supply of raw material of the best type was readily available within a few yards from the river for making lithic tools. All these varied advantages seem to have favoured the habitation of this basin by prehistoric man in the Early Stone Age.

6. On receiving a small representative collection from the Deccan College Research Institute, Poona (India), Dr. Lowe described the specimens as "Upper Indian Acheulean" representing a core-cum-flake cultural entity.

APPENDIX

DETAILED DESCRIPTION OF THE ILLUSTRATED TOOLS[1]

HANDAXES

1. KD-325 : Handaxe on core (pebble). (17 cms. x 8·4 cms. x 7 cms.). Quartzite, slightly rolled. Rounded pebble butt, elongated triangular point, marked by bold and large flake scars. (Fig. 11 and p. 55).

2. KD-515 : Handaxe on core (pebble). (12·9 cms. x 10·2 cms. x 6·7 cms.). Quartzite, slightly rolled. Broad, round pebble butt, short thick triangular point marked by bold and large flake scars. Shows crude workmanship. (Fig. 11 and p. 55).

3. KD-284 : Handaxe on core (pebble). (10·3 cms. x 5·6 cms. x 4 cms.). Quartzite, slightly rolled. Pebble butt, almond-shaped, but the front neatly flaked into a thick tongue-like point. Cross section almost biconvex. (Fig. 11 and p. 55).

4. MNI-197 : Handaxe on core (pebble). (17′4 cms. x 10′8 cms. x 9′1 cms.). Quartzite, slightly rolled. Rounded flaked butt, keeled or pyramidal body and projecting angular point, with wavy edge. (Fig. 12 and p. 55).

5. TML-719 : Handaxe on core (pebble). (10′5 cms. x 7′1 cms. x 6′0 cms.). Quartzite, slightly rolled, short, rounded, thick pebble butt and somewhat triangular point. Long and flat alternate flake scars have produced a zig-zag edge near the point. Shape of the tool is almond-like. (Fig. 13 and p. 55).

6. KD-377 : Handaxe on core, fully flaked. (16′4 cms. x 11′3 cms. x 8′0 cms.). Quartzite, unrolled. Rounded, flaked butt, keeled or pyramidal body and projecting point, wavy edge around. Cortex patches on both the surface. Biconvex to roughly parllelogrammatic section. (Fig. 12 and p. 55).

1. The specimens are described in the same order as they are cited in Section V. The measurements are in centimetres and indicate (maximum length x maximum breadth x maximum thickness).

7. MNI-45 : Hand-axe on core. (13′5 cms. x 10′0 cms x 6′0 cms.). Quartzite, unrolled. Fully and boldly flaked all round. Thick ovate with irregular wavy edge. (Fig. 14, Pl. IV and p. 55).

8. MNI-23 : Handaxe (probably on core). (14′3 cms. x 8′0 cms. x 7′2 cms.). Pale green quartzite, fresh and unrolled. Pointed pear-shaped body with rounded and fully flaked butt, trimmed all round, producing small flat scars. The specimen is very symmetrical and beautiful. Cross-section biconvex. (Fig. 14 and p. 55).

9. MNI-37 : Handaxe on flake. (15′5 cms. x 9′1 cms. x 5′0 cms.). Yellowish quartzite, fresh and unrolled. Pointed pear-shaped body, rounded thick butt, boldly flaked on both the surfaces. Edges sinuous and the cross-section parallelogrammatic. (Fig. 15 and p. 56).

10. MRI-718 : Handaxe on end-flake. (12′9 cms. x 8′1 cms. x 5′0 cms.). Quartzite, rolled. Pointed pear-shaped body. Fully flaked on one face, the scar-beds are large and flat. Two such longitudinal flake scars have produced a prominent mid-ridge, which runs from the point towards the butt end and merges on a mound in the middle. From this mound longish flakes are taken in all directions. The under-surface carries only three small flake scars. The tool appears tortoise-like. The shape near the butt suggests possibility of hafting. Cross-section plano-convex. (Fig. 13 and p. 56).

11. HMG-801 : Hand-axe on flake. (17′0 cms. x 7′4 cms. x 4′2 cms.). Quartzite, slightly rolled. Sub-triangular and flaked butt. A flat surface of the original quartzite block intersects with the flake scars and forms a keel on the upper surface. The under-surface is trimmed by taking flakes from both the sides, the scars of which form a mid-ridge and transverse subsidiary ridges. The sides converge into a well-defined point. Section is plano-convex on the butt and triangular near the point. The tool is comparatively flat on the under-surface and bulging on the front. (Fig. 16 and p. 56).

12. ATD-758 : Hand-axe on end-flake. (15′5 cms. x 7′1 cms. x 3′1 cms.). Quartzite, slightly rolled. Sub-triangular or pointed almond-shaped. Much flaked on the upper surface; scar beds are large but shallow. Under-surface trimmed on the sides only. A vertical flake near the point has produced a graver-like point. Striking platform and the bulb of percussion trimmed. Section bioconvex. (Fig. 16 and p. 56).

13. MNI-39 : Hand-axe on flake. 11′8 cms. x 6′7 cms. x 4′3 cms.) Quartzite, partly weathered and almost unrolled. Pointed pear-shaped

body. Flaked on both the surfaces with a keel on each face. Cross-section parallelogrammatic or rhomboid. (Fig. 16 and p. 57).

14. TML-243 : Hand-axe on flake. (21′0 cms. x 13′0 cms. x 5′7 cms.). Quartzite, fresh and unrolled. Almond-shape. Flaked on both the surfaces resulting in large shallow flake scars. Broad and fully flaked butt and much thinner and sharper, tongue-like projecting point. Section biconvex on the butt, lenticular near the point. (Fig. 17. Pl. I and p. 57).

15. KD-297 : Hand-axe on end (?) flake (22′5 cms. x 11′5 cms. x 6′4 cms.). Red quartzite, fresh and unrolled. Elongated oval-shaped, pointed at both ends. Completely flaked on the front producing steep and large flake scars. On the other surface, the flakes are taken all along the periphery leaving a large primary flake surface in the centre unworked. Section perfectly biconvex near the butt. (Fig. 18 and p. 57).

16. KD-288 : Hand-axe on flake. (19′7 cms. x 9′2 cms x 5′0 cms.). Red sandstone, little weathered and rolled. Worked on a wide-angled (120°) side flake. Elongated oval-shaped, pointed at both ends. Completely trimmed on the front producing a mid-ridge. The upper surface shows a prominent bulb of percussion. Flaked on the striking platform and also on the sides. (Fig. 19, Pl. II and p. 57).

17. KD-292 : Hand-axe on flake. (11′9 cms. x 7′6 cms. x 3′8 cms.) Quartzite, fresh and unrolled. Double-pointed oval-shape. Boldly flaked on both the surfaces. Some step flake-scars are visible on each face. Somewhat wavy edge all round. A big scar near one end is produced by a blow directed obliquely from the edge towards the centre which has resulted into a curved beak-like point. Perhaps this tool was used as a side-scraper-cum-hand-axe. (Fig. 20, Pl. III and p. 57).

18. KD-315 : Hand-axe on flake. (10′5 cms. x 7′4 cms. x 4′0 cms.). Quartzite, fresh and unrolled. Perfect ovate. One face shows fine flake scars and is completely flaked, the other surface worked along the margin only. One side distinctly wavy. (Fig. 21 and p. 58).

19. KD-343 : Hand-axe on side-flake. (16′5 cms. x 11′2 cms. x 4′6 cms.). Red sandstone, fresh and unrolled. Perfect almond-shaped, neatly flaked on both the surfaces. Number of flake scars suggest step technique. Retouched at some places on the side which is sharp and even. The specimen is thicker at one end. Roughly triangular cross-section. A beautiful tool in colour and workmanship. (Fig. 17, Pl. I and p. 58).

20. MNI-59 : Hand-axe on end-flake. (10′4 cms. x 8′1 cms. x 3′7 cms.). Grey quartzite, unrolled. Cordiform. The front is step-flaked all round, leaving a small triangular yellow-brown cortex near the butt unworked. The under surface worked along the edge and on the striking platform. Finely retouched on one side. Section-biconvex. (Fig. 21 and p. 58).

21. KD-435 : Hand-axe on flake. (10′5 cms. x 8′0 cms. x 5′0 cms.). Pink quartzite, very little rolled. Sub-triangular shape. Well trimmed on both the surfaces, edge retouched and worn. Somewhat keeled on the other surface. Cross-section biconvex. (Fig. 20 and p. 58).

22. CMG-797 : Hand-axe on end-flake. (10′2 cms. x 6′5 cms. x 5′0 cms.). Quartzite, much rolled. Trifaced tool. A thick end-flake is taken from a pebble and flaked on the front producing a keel which runs from end to end. The under surface shows only two bold and steep flake scars which intersect with similar scars on the second face and produce a wavy edge. Butt thick and flat on the end. Cross-section triangular. Somewhat tetrahedral body. (Fig. 22 and p. 59).

23. KLR-744 : Hand-axe on end flake. (13′2 cms. x 8′4 cms. x 3′ cms.) Quartzite, weathered and rolled, stained with yellowish clay. The upper surface shows small step-flake scars near the butt and the point, sides retouched. The under surface is unworked and carries a prominent bulb of percussion. A lens-shaped striking platform on the butt-end makes 95° angle with the primary flake surface. Shape of the tool is roughly triangular. Cross-section biconvex to lenticular. (Fig. 22 and p. 59).

24. KD-332 : Chisel-edged hand-axe on flake (12′3 cms. x 8′5 cms. x 5′0 cms.). (Chisel edge—5′6 cms.). Quartzite, rolled and little weathered. Trimmed all round with bold but somewhat flat flake-scars. Triangular and thick butt. Two small, bold and steep flake scars are visible on either side just below the working edge which suggest possibility of hafting. The chisel-edge is formed by natural thinning of the primary flake surface towards that end. (Fig. 23 and p. 59).

25. KD-518 : Hand-axe on flat pebble. (18′5 cms. x 10′4 cms. x 3′6 cms.). Red sandstone slightly rolled. A flat rectangular pebble is boldly flaked at one of the corners and on the two adjacent sides. One face is half flaked and the second is slightly worked near the point only. The point is made thin by taking two flat and elongated flakes vertically from the point. Butt squared and carries a small original pebble surface. (Fig. 23 and p. 59).

26. KD-378 : Hand-axe (Larsen Type). (20′1 cms. x 10′5 cms. x 5′2 cms.). Hornblende schist, slightly weathered and rolled. A flat pebble is partially trimmed into a thin projecting point. All the flake scars suggest step-technique. The projecting point is obtained by taking 2-3 flakes vertically from the end, which have produced deep step-flake scars. The cleavage of the rock seems to be responsible in producing step-flake scars. Section III roughly biconvex. (Fig. 24, Pl. III and p. 59).

27. MNI-140 : Hand-axe on side-flake. (15′6 cms. x 9′6 cms. x 3′7 cms.). Pink quartzite, almost unrolled. Probably a real graver or burin with flat surfaces, comparatively thick rounded butt, and the point made by trimming on either side showing a flake scar, the other by a series of three or four flake scars. Step flaking common. Section roughly trapezium. (Fig. 25 and p. 59).

28. MNI-153 : Hand-axe on side-flake. (15′4 cms. x 7′1 cms. x 4′5 cms.). Grey quartzite, slightly rolled. Trimmed on the upper surface and around the butt only, the point perhaps made by a genuine vertical cut. Finely flaked by step-technique. Section parallelogrammatic. (Fig. 25 and p. 59).

29. KD-853 : Pick-like hand-axe. (26′8 cms. x 9′0 cms. x 7′2 cms.). Dark chocolate coloured quartzite, slightly rolled. Somewhat cigar-shaped, tappering at both the ends. Boldly flaked all round. Section parallelogrammatic. (Fig. 26, Pl. II and p. 60).

30. A-2 : Restroid hand-axe. (10′6 cms. x 7′1 cms. x 6′1 cms.). Quartzite, almost unrolled. Probably a very thick end-flake was taken from a lump of quartzite for preparing this tool. Butt thick and eagle beak-shaped point. Cross-section sub-triangular. (Fig. 15 and p. 60).

CLEAVERS

31. KD-549 : Cleaver on end-flake. (16′0 cms. x 9′6 cms. x 4′3 cms.; Edge—16′0 cms.). Quartzite, almost unrolled. Well trimmed all round. Rounded butt with a lens-shaped striking platform on the butt end. One face shows a keel that runs from the butt to nearly half the length of the tool. The cleaver edge is oblique (makes 105°-110° angle with the main axis.), blunt, thick and curved, and much broader than the average breadth of the tool. Cross-section biconvex. (Fig. 28 and p. 61).

32. MNI-75: Cleaver on end-flake. (13′6 cms. x 9′5 cms. x 5′0 cms.; Edge—11′0 cms.). Quartzite, unrolled. Thick and roughly trimmed butt. The under-surface (primary flake surface) nearly three-fourths flaked with flat step-flake scars. Cutting edge oblique and uncurved. Cross-section roughly parallelogrammatic. (Fig. 27 and p. 61).

33. HMG-806: Cleaver on end-flake. (15′0 cms. x 8′6 cms. x 5′5 cms.). Quartzite, weathered and rolled. Rounded flaked butt, parallel and very finely trimmed sides. Cutting edge oblique and worn. Under surface much convex with a mound in the centre near the butt end and sloping steeply and radially from it. Cross-section trapezoid. Comparable to Stellenbosch-III cleavers on end-flakes. (Fig. 29 and p. 61).

34. KD-421: Cleaver on end-flake. (16′6 cms. x. 14′3 cms. x 3′7 cms.). Chocolate-coloured fine grained sand-stone, very little rolled. Slightly convex and trimmed butt, sides alternately flaked with a number of small or big step-scars. Convex, flaring cutting-edge, finely retouched by alternate flaking all along the length. Nearly half the portion on each face towards the butt end is flaked. Possibly hafted. Cross-section biconvex. (Fig. 30, Pl. V and p. 62).

35. KD-458: Cleaver on end-flake. (17′1 cms. x 13′8 cms. x 5′3 cms.). Coarse-grained, chocolate-coloured quartzite, slightly rolled. Thick convex butt, divergent sides and convex but angular edge. Well worked. (Fig. 31 and p. 62).

36. KD-359: Cleaver on end-flake. (17′6 cms. x 10′2 cms. x 4′6 cms.). Quartzite, slightly rolled. Angular pointed butt formed by the meeting of: (i) the original cleavage plane, (ii) the flatter flaked side, and (iii) a portion of unflaked under surface. One side boldly flaked alternately with a wavy edge. Rough, angular and abraded cutting edge. This may be described as a cleaver-cum-handaxe. Cross-section—approximately parallelogrammatic. (Fig. 29 and p. 62).

37. KD-426: Cleaver on end-flake. (14′0 cms. x 9′6 cms. x 4′3 cms.). Quartzite, weathered and slightly rolled. Rounded butt and convergent sides. Alternately flaked on the sides and round the butt-end also. Hollowed cutting edge, slightly wavy and worn. Number of step-flake scars visible on both the surfaces. It is a well finished specimen. Section-biconvex. (Fig. 32, Pl. V and p. 62).

38. KD-416: Cleaver on end-flake. (12′ cms. x 10′0 cms. x 3′5 cms.). Quartzite, very little rolled. Rectangular shape. Squared butt with a striking platform on its end, flaked on one side only. One side very

finely retouched, the other worked in one direction only, and both almost parallel. The under surface is worked on one side, while the front is trimmed completely and is comparatively flat. Cutting edge straight and much abraded. Section roughly biconvex. Comparable to Stellenbosch-III and IV cleavers on end-flakes. (Fig. 27 and p. 62).

39. KD-419 : Cleaver on end-flake (with bulb of percussion and striking platform unworked). (14′2 cms. x 11′0 cms. x 5′0 cms.; Edge 11′0 cms.). Rectangular shape. Squared and untrimmed butt with a lenticular striking platform on its end. Well trimmed parallel sides, straight and worn cutting edge. The under surface is worked on one side only by step-technique. The front is fully flaked and carries a prominent diagonal keel. The implement is thick on the butt and side. A beautifully worked specimen. Cross-section asymmetrical biconvex. (Fig. 33 and p. 62).

40. KD-466 : Cleaver on end-flake. (The angle between the striking platform and the primary flake surface—90°). 12′2 cms. x 9′1 cms. x 3′4 cms.). Quartzite, very little rolled. Thick, squared and untrimmed butt with elongated striking platform at its end. Sides curved and finely flaked on the upper surface only. Two flat and longitudinal blade-like flake scars are seen on the front face which run from the cutting edge to the butt end. The under surface is not worked. Section trapezoid to asymmetrical biconvex. (Fig. 33 and p. 62).

41. KD-422 : Cleaver on side (?) flake. (13′2 cms. x 9′9 cms. x 3′1 cms.). Quartzite, very little rolled. Triangular shape. Pointed butt, sides strongly convergent and flaked in one direction only. Step-flaking common. Cutting edge convex, thin and slightly retouched. One end of the edge is broken. Cross-section parallelogrammatic. (Fig. 32 and p. 62).

42. MNI-74 : Cleaver on side flake. (angle between the striking platform and the flake surface—122°). (13′9 cms. x 9′4 cms. x 5′0 cms.). Red quartzite, unrolled. Thick, squared butt; sides almost parallel and worked in one direction only with blows directed towards the central pyramidal projection. The under surface unworked, and flat. Cleaver edge oblique and battered. Section-triangular. (Fig. 34 and p. 62).

43. KD-388 : Cleaver on side-flake. (12′8 cms. x 9′0 cms. x 4′0 cms.). Red, fine-grained sandstone, unrolled. Conical or convex butt, sides convergent and well trimmed. Front face flaked three-fourth and under-surface worked on sides only. Section approximately biconvex. (Fig. 34 and p. 63).

44. MNI-151 : Cleaver on side-flake (19′1 cms. x 11′4 cms. x 5′1 cms.). Fine-grained grey quartzite, little weathered and rolled. Short squared and slightly flaked butt. Much flaked on the front leaving a longitudinal cortex patch in the centre, the under surface worked on one side only. Both the sides are convex. Cutting edge short and straight. Section parallelogrammatic. Comparable to Stellenbosch I cleavers. (Fig. 35 and p. 63).

45. MNI-152 : Cleaver on side-flake. (21′2 cms. x 11′7 cms. x 6′0 cms.). Quartzite, slightly weathered and coated with yellowish clay, unrolled. Rounded butt, straight and abraded cutting edge. Section approximately biconvex. (Fig. 36 and p. 63).

46. KD-333 : Cleaver on flake (12′2 cms. x 8′0 cms. x 3′4 cms.). Quartzite, fresh and unrolled. Rounded butt, convergent sides and a thin cleaver edge. Well trimmed all round producing tiny scar-beds. Finely retouched on the sides and on the cleaver edge. Section lenticular. A very beautiful specimen with U-shaped form. (Fig. 34, Pl. V and p. 63).

47. KD-410 : Cleaver on end-flake. (12′7 cms. x 9′1 cms. x 3′6 cms.). Banded, dark brown quartzite, almost unrolled. Rounded, thin and flaked butt, and short, straight cutting edge. Sides, butt and the cleaver edge are alternately flaked, resulting in a fine wavy edge around. The tool is roughly U-shaped and one of its sides shows a distinct S-twist. Thick in one corner, section biconvex. (Fig. 28 and p. 63).

Cores :

48. KD-220 : Core. (12′5 cms. x 11′9 cms. x 5′6 cms.). Quartzite, little rolled. Discoidal core. Bold flaking has produced deep flake scars and an irregular sinuous edge. (Fig. 37 and p. 64).

49. KD-524 : Core-cum-chopper (12′3 cms. x 8′6 cms. x 5′2 cms.). Quartzite. An ovoid pebble is taken and only a few flakes are removed on the sides by alternate strokes. This might have been used as a side-chopper. (Fig. 39 and p. 64).

Choppers :

50. KD-528 : Chopper. (14′ cms. x 12′3 cms. x 6′5 cms.). Quartzite, weathered and rolled. A rolled disc-shaped large pebble is taken and boldly flaked alternately on the side producing a wide sharp, wavy edge along half the periphery. A part of the pebble surface is left unworked for hand-grip. (Fig. 38 and p. 64).

51. M. Gorge-826 : Chopper. (16′0 cms. x 13′4 cms. x 6′5 cms.). A rectangular, flat and rolled block of quartzite, initially stained red, is taken and boldly flaked on one side alternately into a crude wavy edge. The other two parallel sides are also partly flaked. It might have served as a crude-chopper. (Fig. 38 and p. 64).

52. TML-249 : Chopper. (8′5 cms. x 7′4 cms. x 4′2 cms.). Quartzite. A roundish pebble, slightly flaked by alternate strokes along a flat edge, giving a short, irregular, dull edge. (Fig. 39 and p. 64).

CORE SCRAPERS.

53. ATD-760.: Core-scraper. (11′0 cms. x 7′4 cms. x 5′1 cms.). Green quartzite. An oval-shaped pebble taken and split in the form of a wedge. Flakes are taken from both the surfaces and from the edge towards a convex butt. Perhaps used as a side-scraper. Fig. 39 and p. 64).

54. CMG-791 : Core-scraper. (10′2 cms. x 8′0 cms. x 5′7 cms.). Quartzite, rolled. A rectangular rolled and weathered pebble is taken and a few flakes are removed on one side, the rest being unworked. The scars have produced a wavy scraper-edge. (Fig. 39 and p. 64).

55. CMG-790 : Core-scraper. (11′1 cms. x 8′6 cms. x 3′2 cms.). Quartzite, slightly rolled. A discoidal pebble is taken, and at one end two or three flakes are removed in one direction only. This specimen might have been used as a rough end-scraper. (Fig. 39 and p. 64).

FLAKES :

56. MNI-164 : Flake (12′4 cms. x 12′0 cms. x 4′5 cms.). Quartzite. A flake with two positive bulbs of percussion. The angle between the primary flake surface and the striking platform is 125 °. (Fig. 40 and p. 65).

57. KD-547 : Flake (7′7 cms. x 6′7 cms. x 2′7 cms.). A wide angled (110°) flake from a pebble with much cortex on one face and the striking platform. A few small flakes seem to have been taken along the margin on the front face. The other face is unworked. (Fig. 40 and p. 65).

58. TML-270 : Flake. (6′0 cms. x 6′6 cms. x 1′8 cms.). Quartzite. A flake from a rolled pebble with convex striking platform, sharp keel on the front and unworked under surface. (Fig. 40 and p. 65).

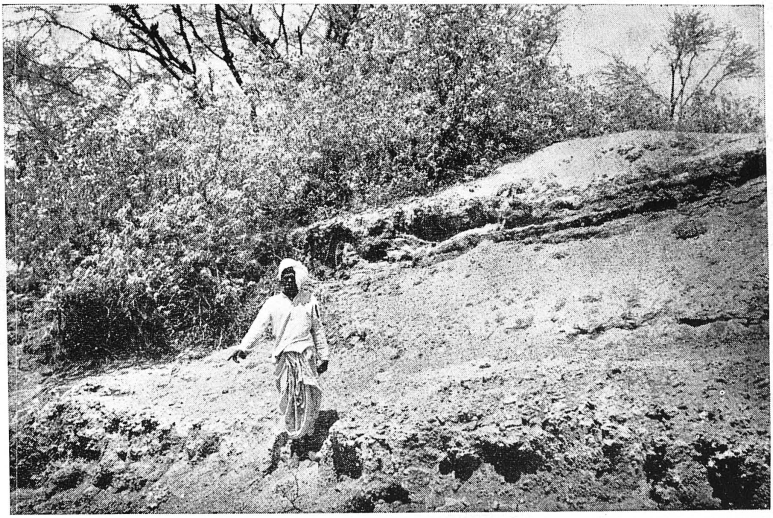
59. CMG-776 : Flake. (6′5 cms. x 4′6 x 1′5 cms.). Quartzite, little weathered and rolled. Thin flake, flat under surface, and finely trimmed upper surface. (Fig. 41 and p. 65).

60. M. Gorge: Flake. (10′0 cms. x 7′7 cms. x 3′0 cms.). Quartzite, stained red or patinated and rolled. Worked along the periphery by alternate strokes. This specimen may be described as a discoid. (Fig. 41 and p. 65).

61. MRI-717: Side-scraper on flake. (11′0 cms. x 5′0 cms. x 3′0 cms.). Red quartzite. Elongated rectangular body. One edge alternately flaked with fine flake-scars, the other side thicker and very little worked. (Fig. 41 and p. 65).

62. H-Tag: Side-scraper on flake. (8′5 cms. x 6′3 cms. x 2′8 cms.). Cherty quartzite, almost unrolled. Broad, flat-topped squared butt and convex edge. Flaked from the edge towards the butt end. (Fig. 41 and p. 65).

PLATE VI



(A) A cliff on the left bank of the river near Hire Mulangi, showing cemented tool-bearing gravel and the brown sand. (See also Fig. 9).

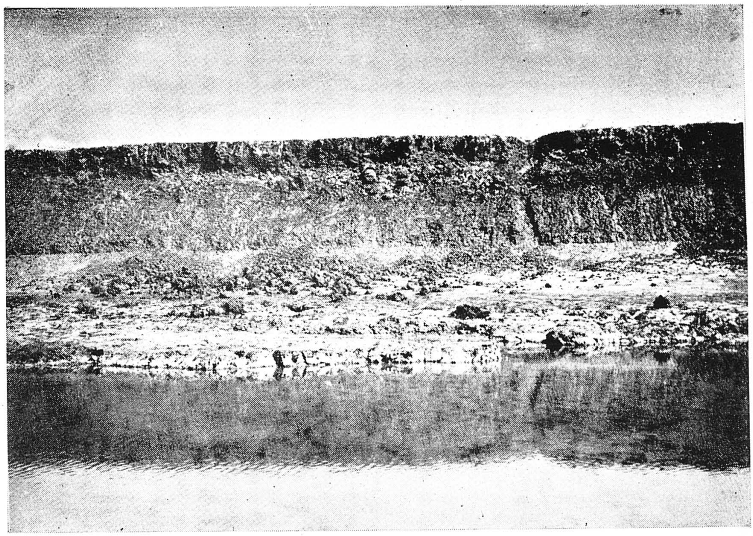
(B) Another view of the gravel at the same site.

PLATE VII

(A) Gravel spread and a remnant of the cemented gravel near Chik-Mulangi.

(B) Left bank of the river near Alur (Talakvad). The cliff shows implementiferous gravel, brown sand and black soil. (See also Fig. 9).

PLATE VIII



(A) Left bank of the Benni Halla near Navalgund, consisting of brown sand and black soil.

(B) Left bank of the Benni Halla near Malvad consisting only of black soil.

(A) Left bank of the river opposite Maneri. Cliff shows "in situ" gravel.

(B) Left bank of the river near Khyad.

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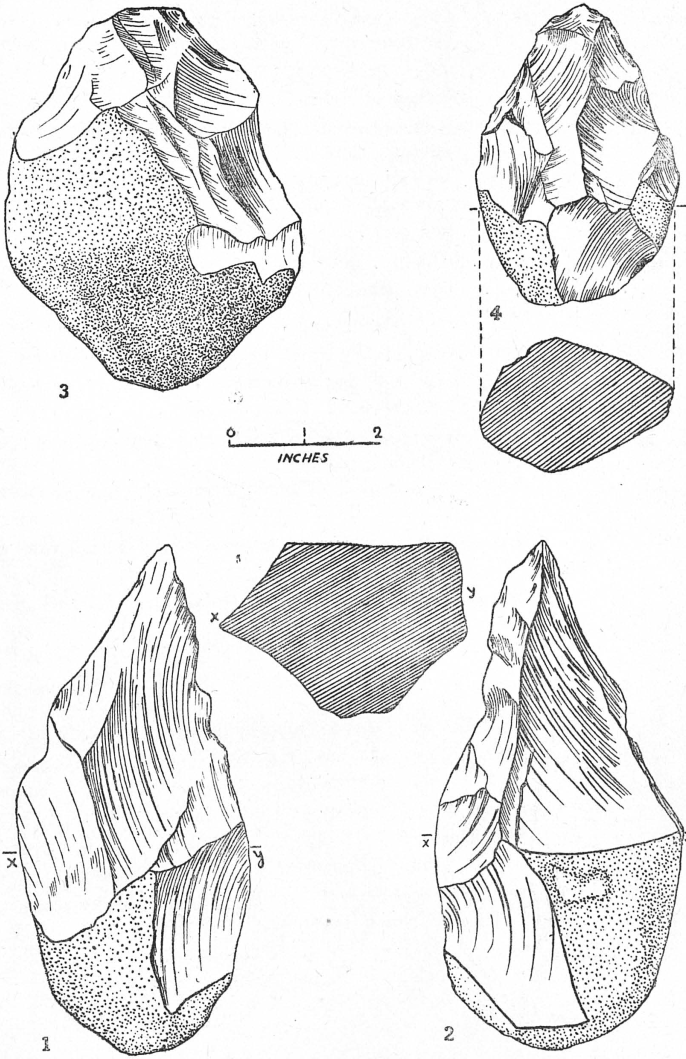

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Fig. 11

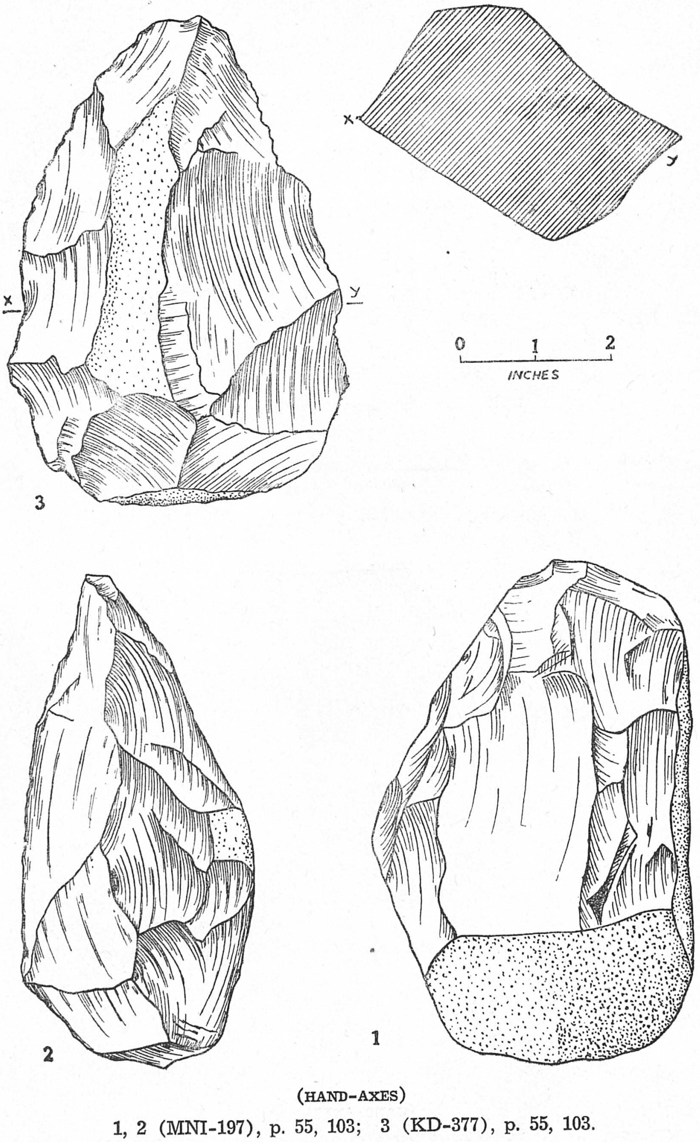

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Fig. 12

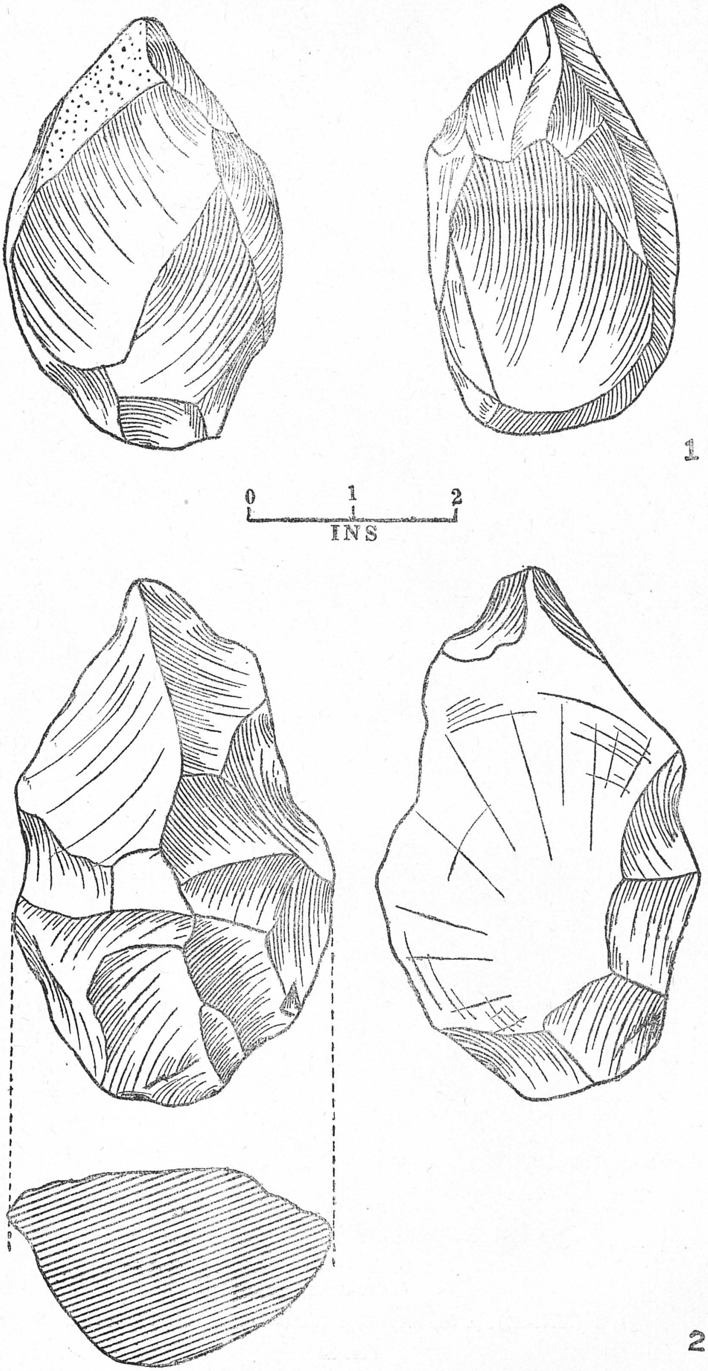

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Fig. 13

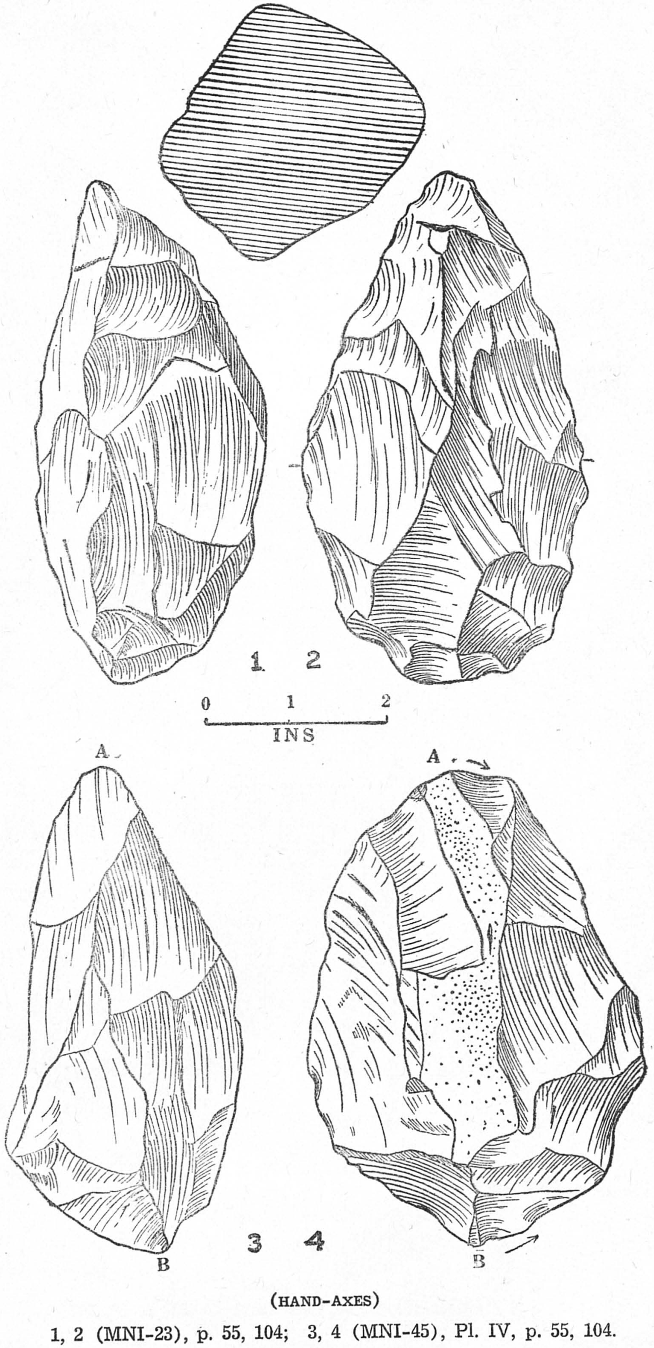

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Fig. 14

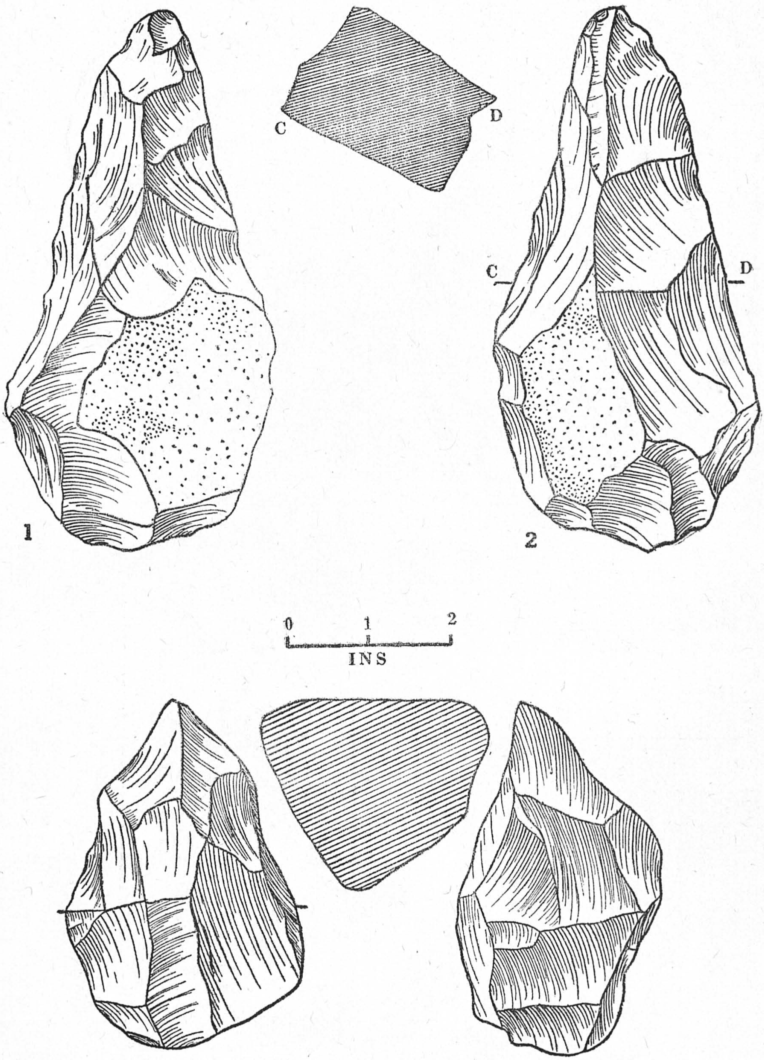

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Fig. 15

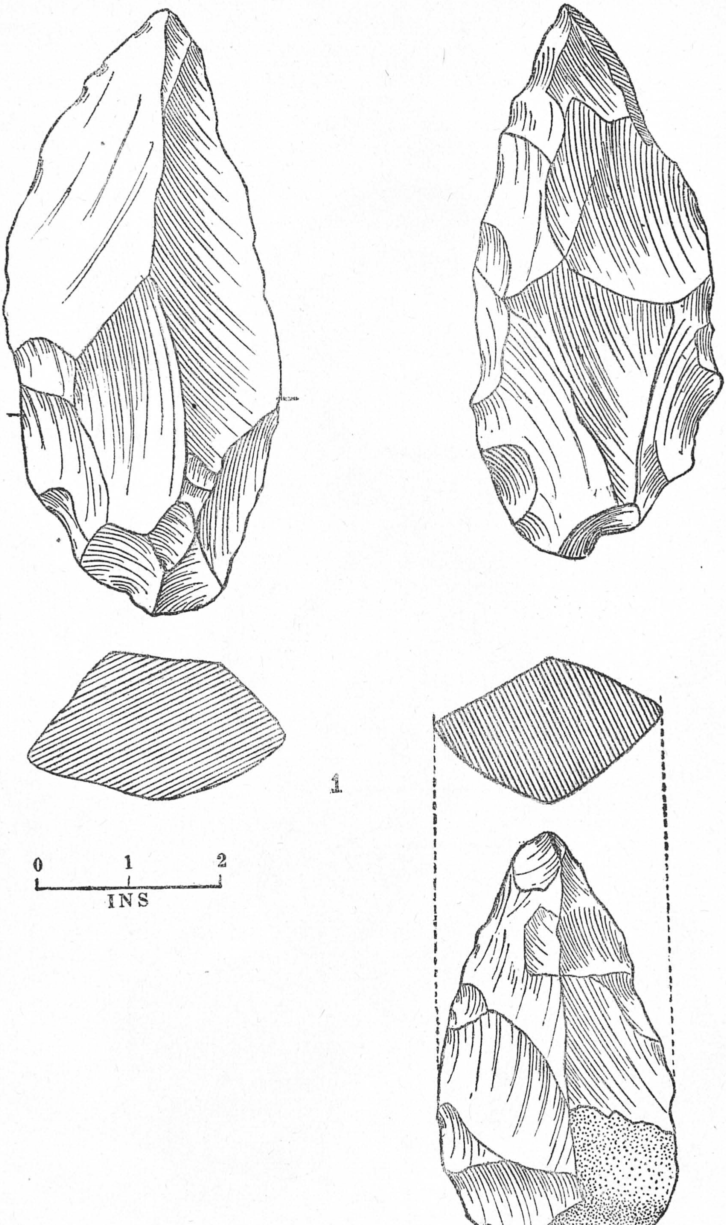

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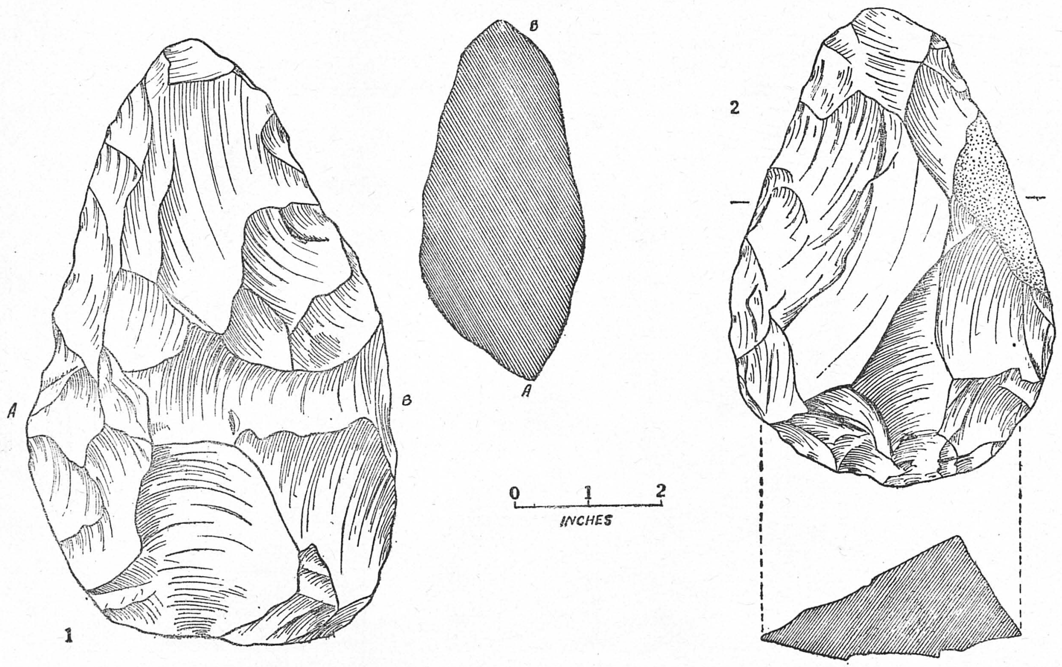
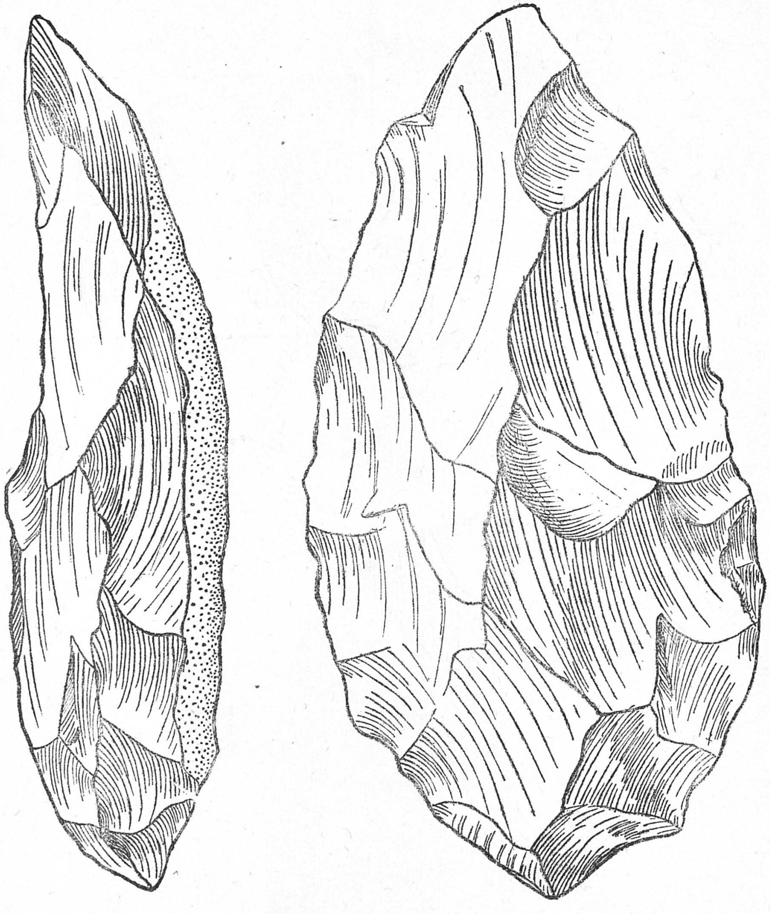
Fig. 16

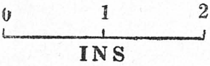
Fig. 17



(HAND-AXE)

1 (TML-243), Pl. I, p. 57, 105; 2 (KD-343), Pl. I, p. 58, 105.



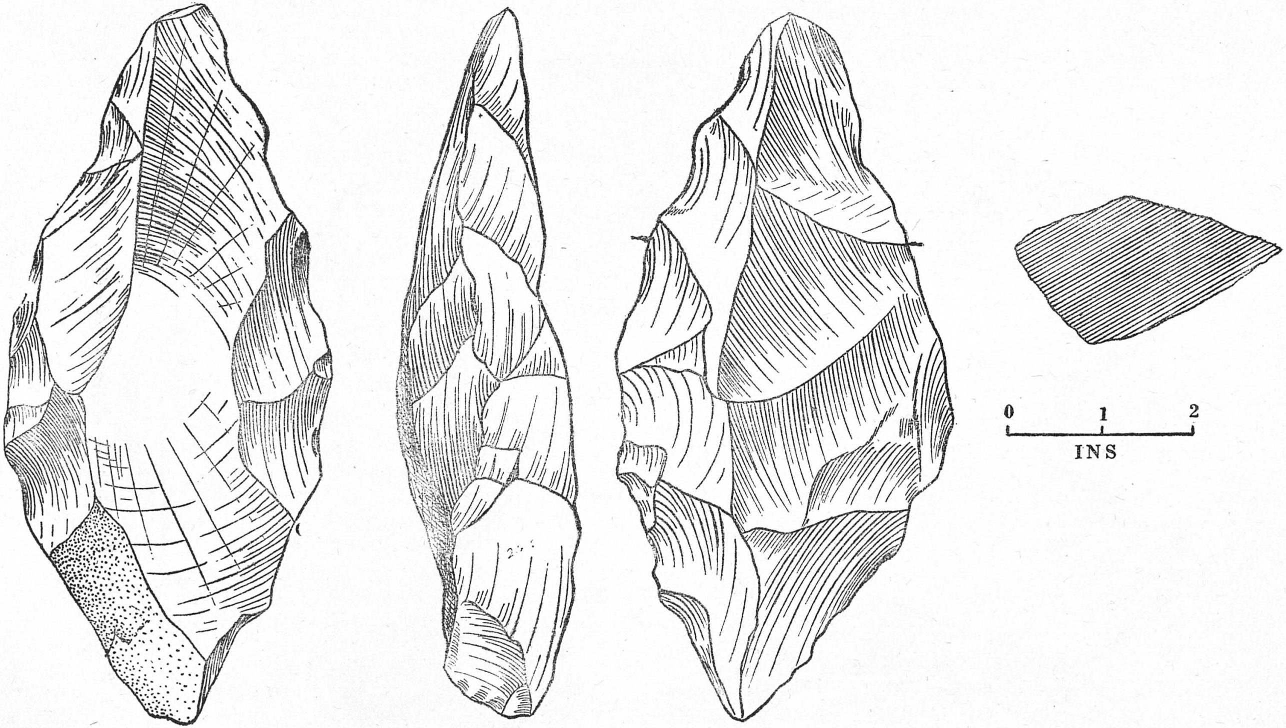


(KD-297), p. 57, 105.

(HAND-AXE)

Fig. 18

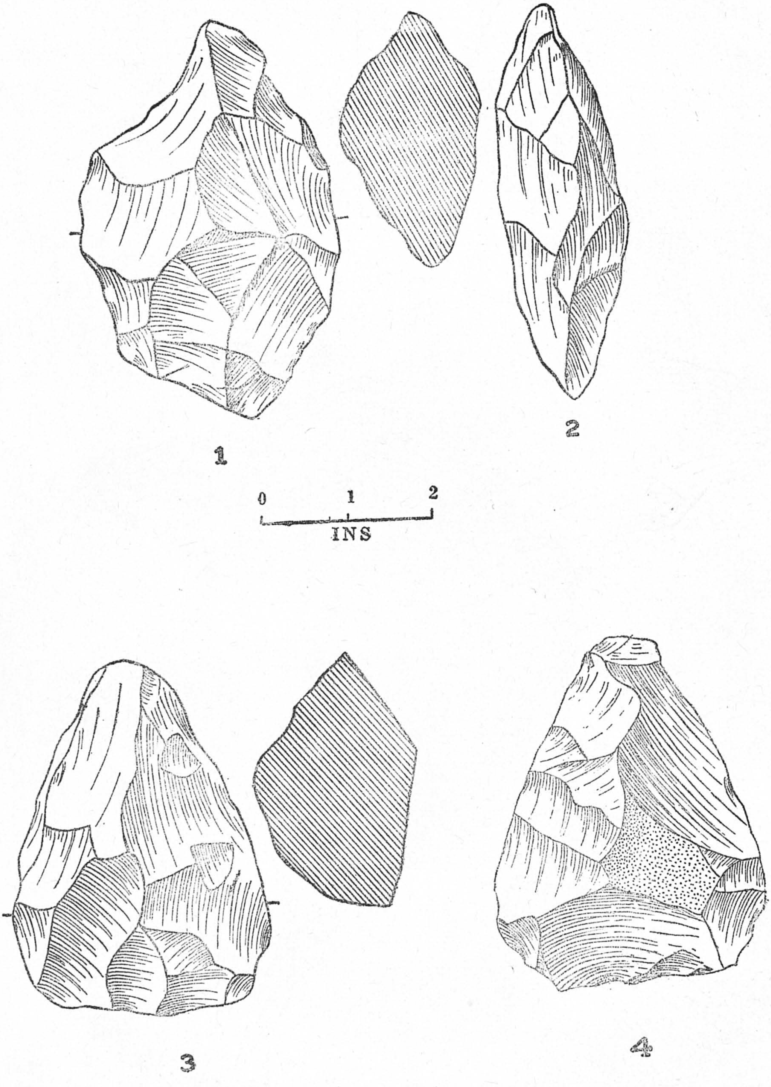
Fig. 19



1 2 3

(HAND-AXE)

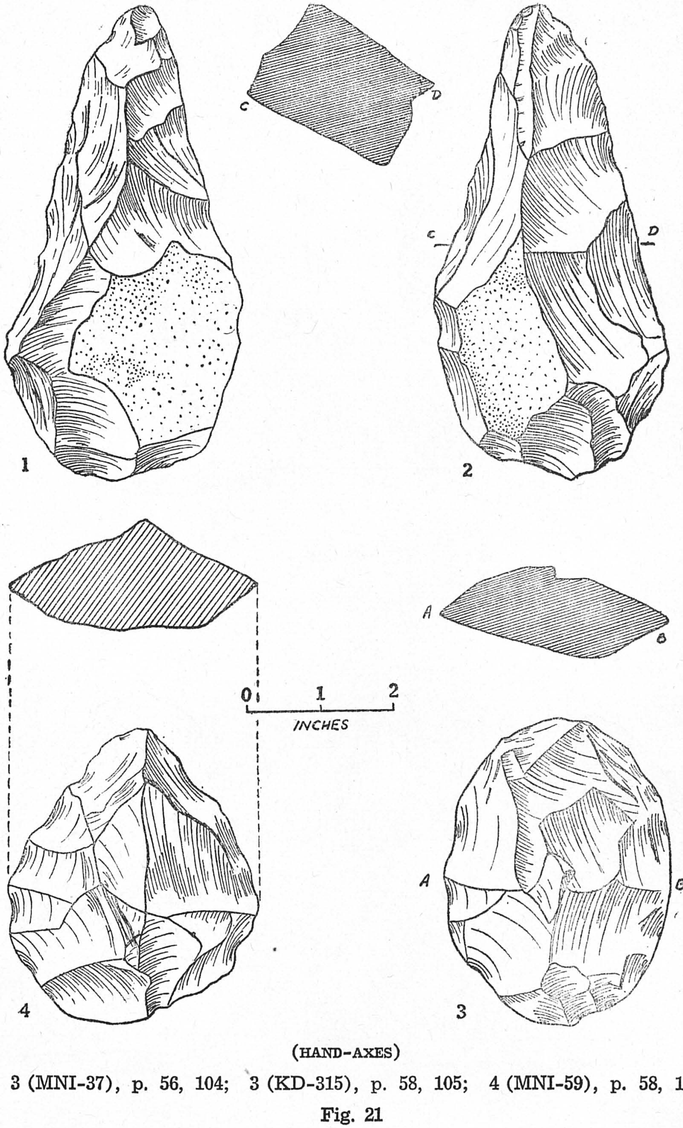
1, 2, 3 (KD-288), Pl. II, p. 57, 105.



(HAND-AXES)

1, 2 (KD-292), Pl. III, p. 57, 105; 3, 4 (KD-435), p. 58, 106.

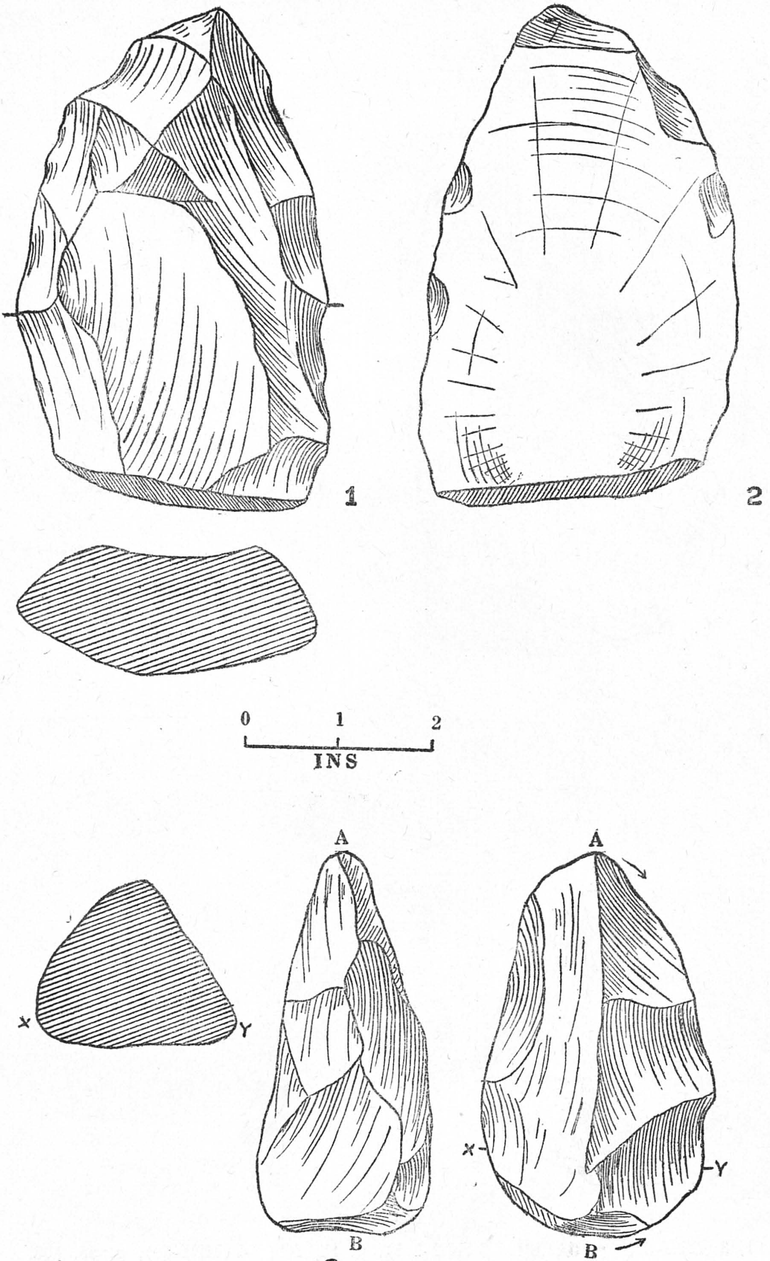
Fig. 20



(HAND-AXES)

1, 3 (MNI-37), p. 56, 104; 3 (KD-315), p. 58, 105; 4 (MNI-59), p. 58, 106.

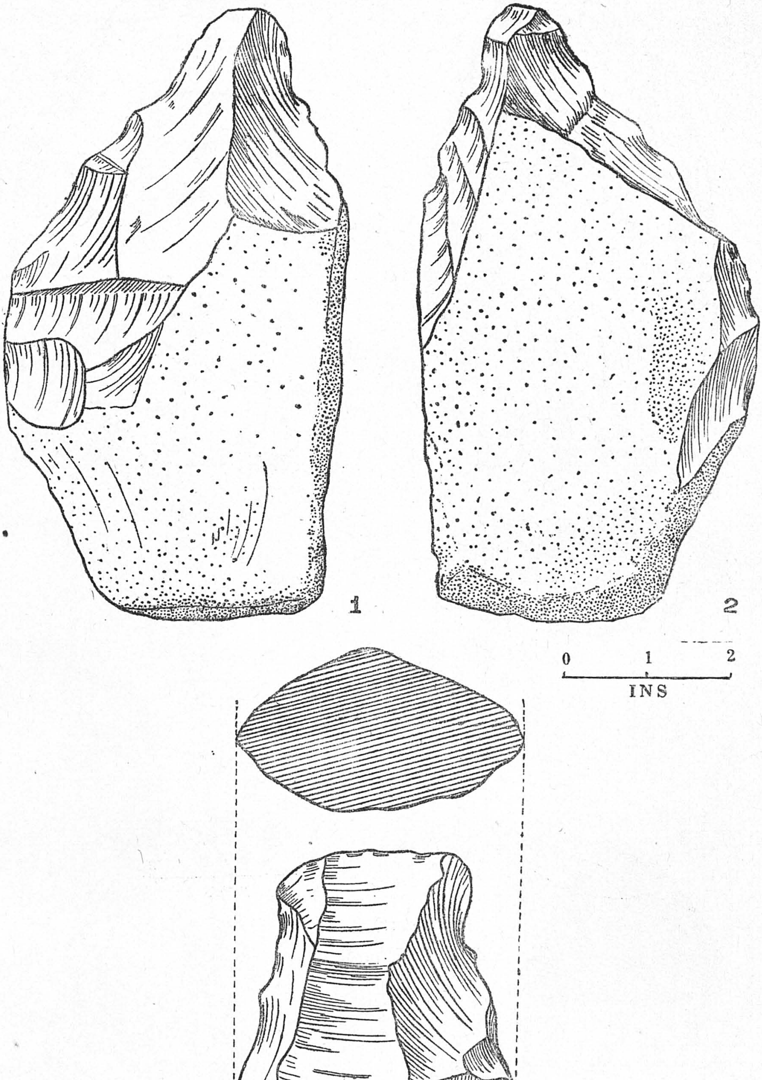
Fig. 21



(HAND-AXES)

1, 2 (KLR-744), p. 59, 106; 3, 4 (CMG-797), p. 59, 106.

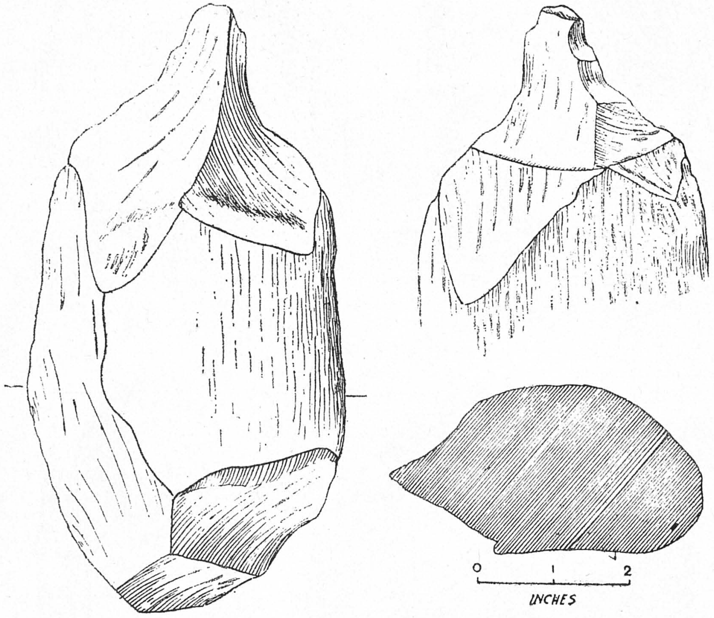
Fig. 22



(HAND-AXES)

1. 2 (KD-518), p. 59, 106; 3 (KD-332), p. 59, 106.

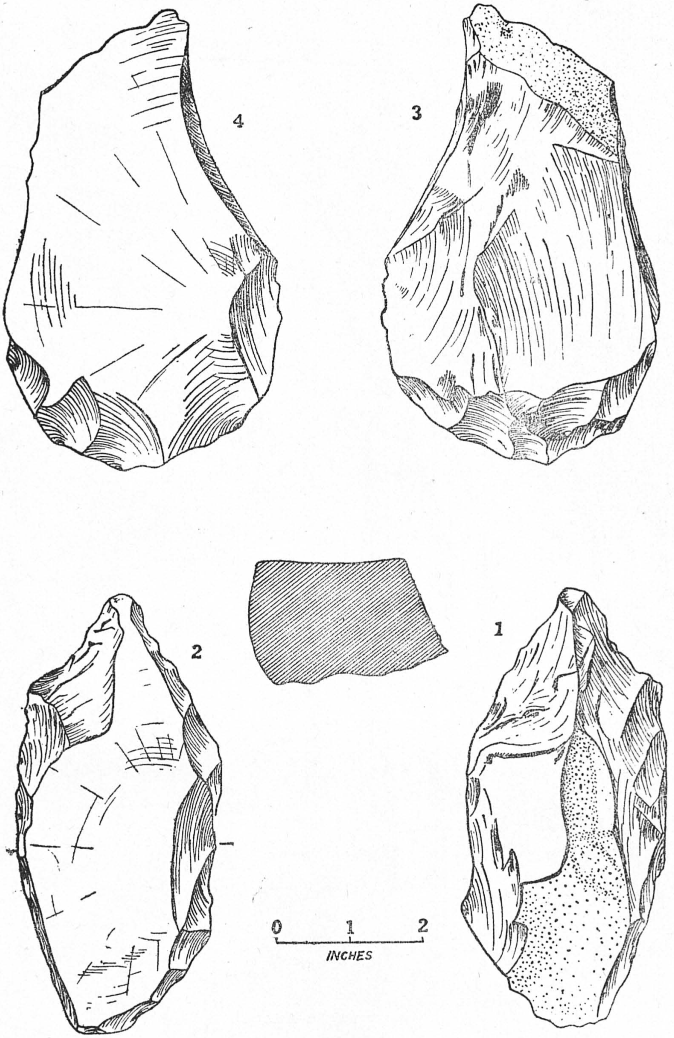
Fig. 23



(HAND-AXE)

(KD-378), Pl. III, p. 59, 107.

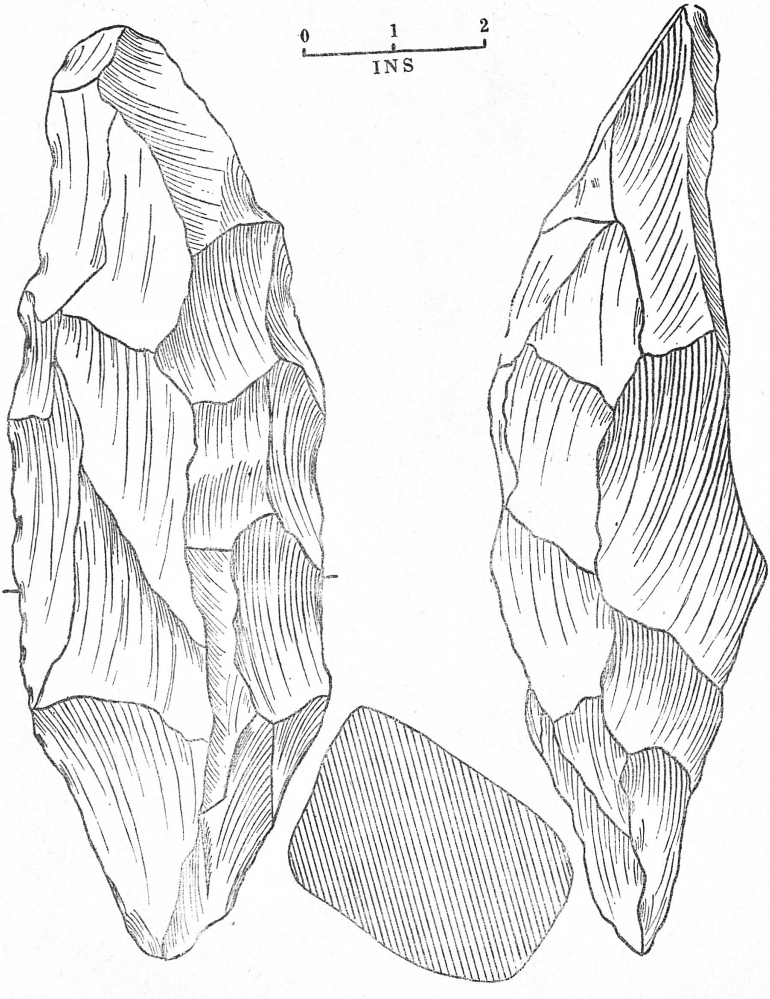
Fig. 24



(HAND-AXES)

1, 2 (MNI-153), p. 59, 107; 3, 4 (MNI-140), p. 59, 107.

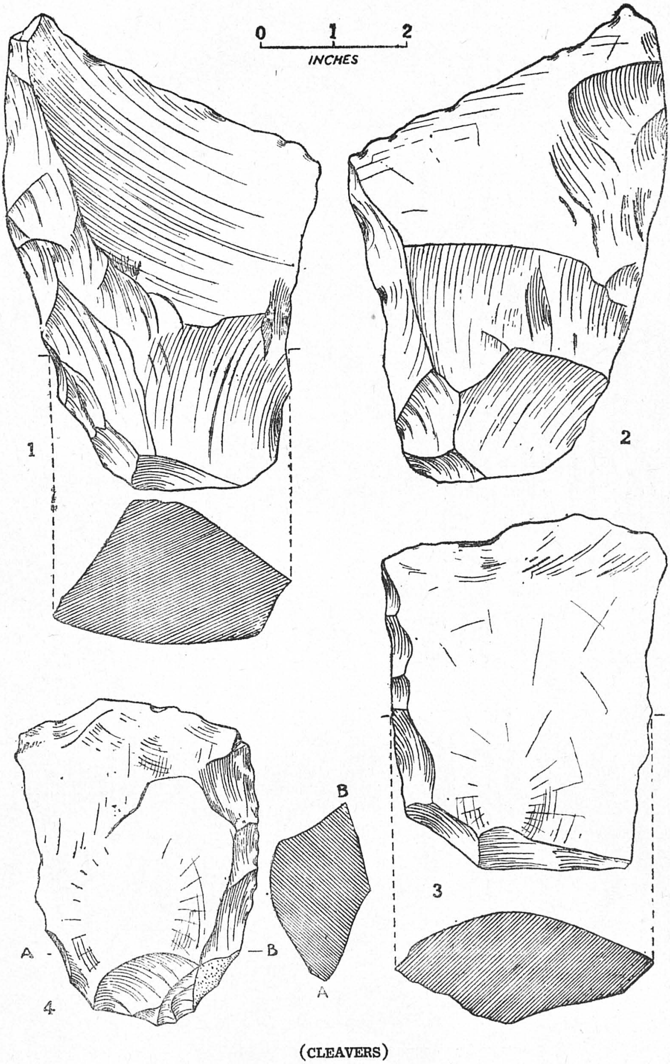
Fig. 25



(HAND-AXE)

(KD-853), Pl. II, p. 60, 107.

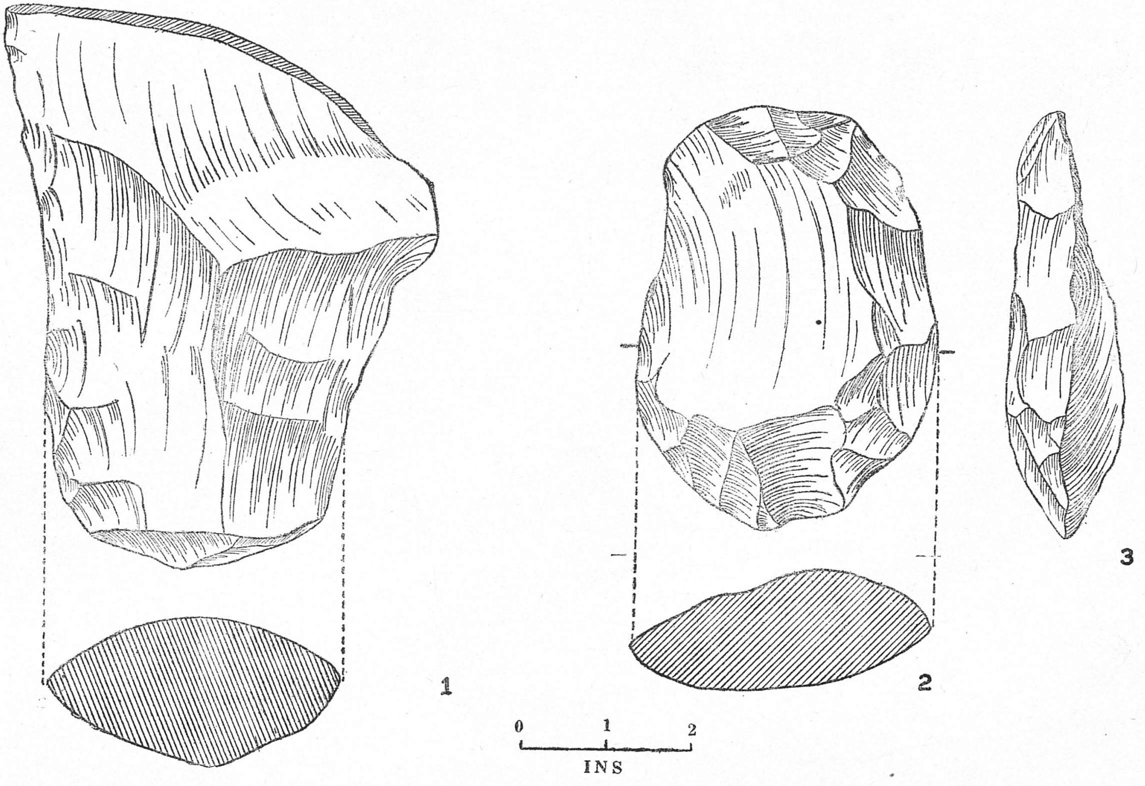
Fig. 26



(CLEAVERS)

1, 2 (MNI-75), p. 61, 108; 3 (KD-416), p. 62, 108; 4 (KD-X).

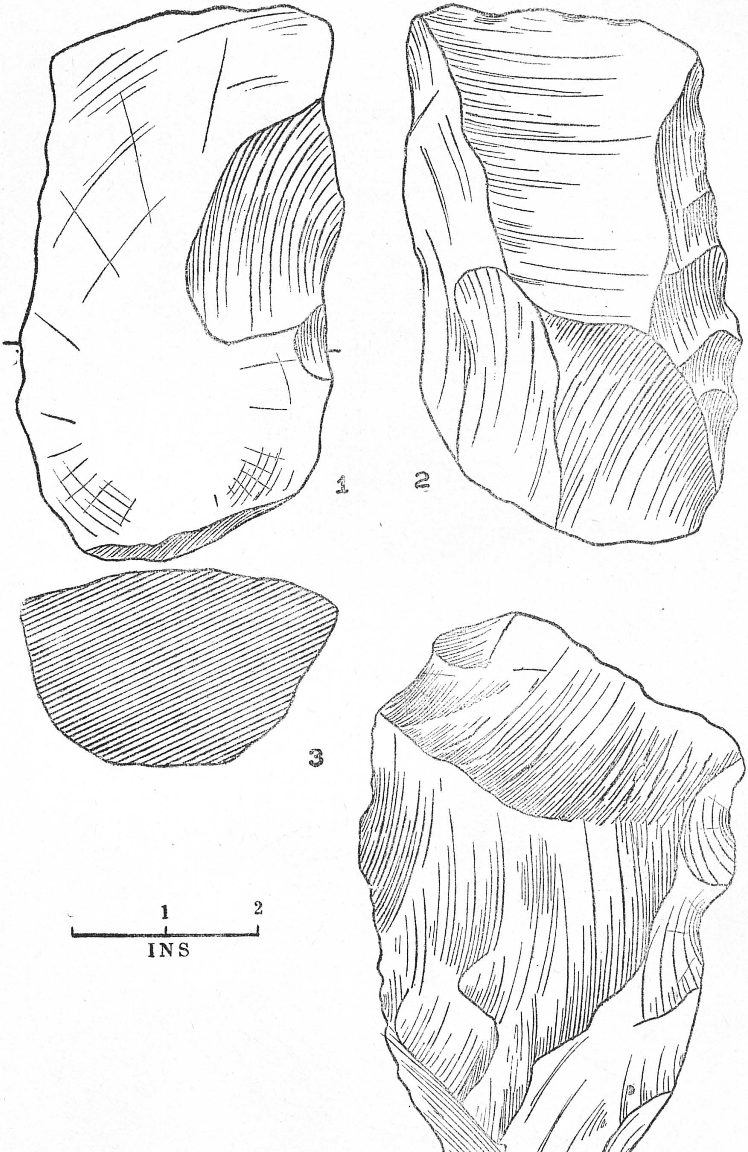
Fig. 27



(CLEAVERS)

1 (KD-549), p. 61, 107; 2, 3 (KD-410), p. 63, 110.

Fig. 28

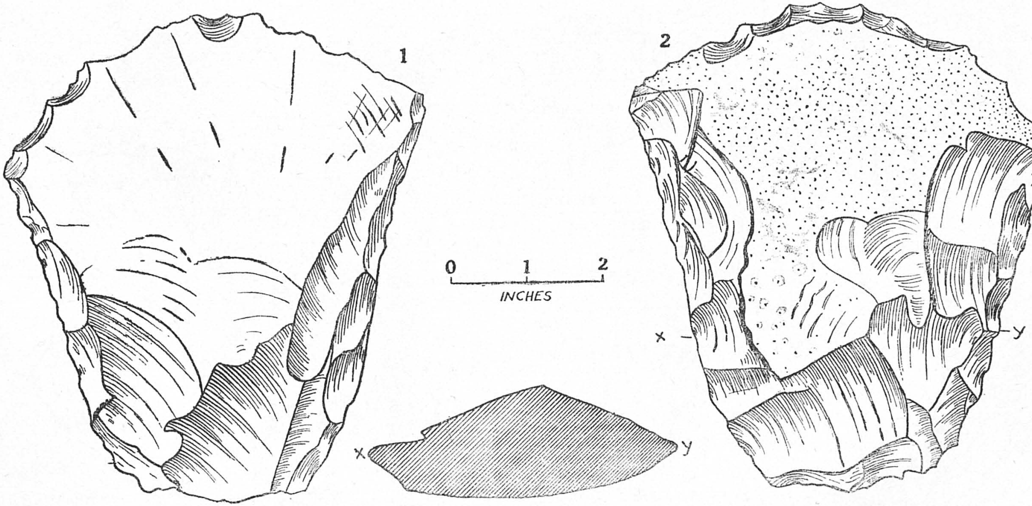


(CLEAVERS)

1, 2, 3 (HMG-806), p. 61, 108; 4 (KD-359), p. 62, 108.

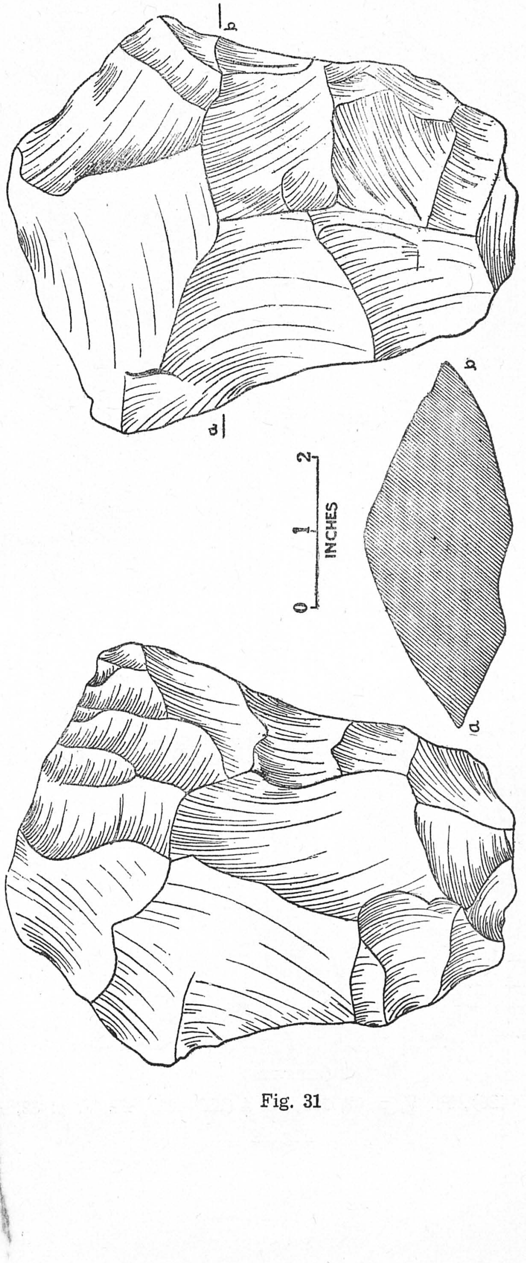
Fig. 29

Fig. 30



(CLEAVER)

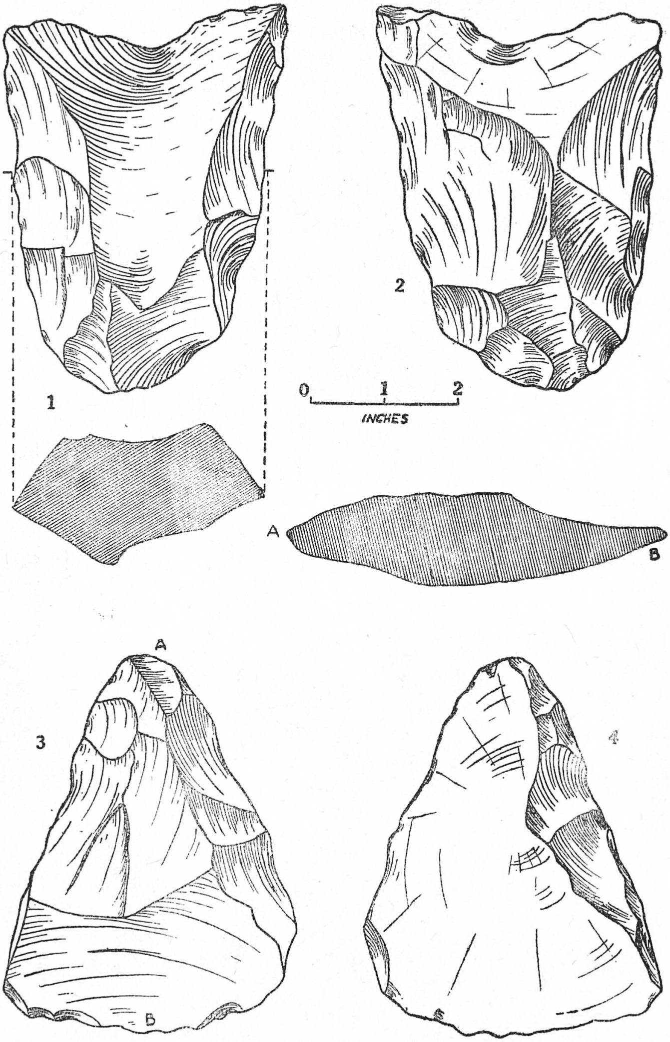
(KD-421), Pl. V, p. 62, 108.



(CLEAVER)

(KD-458), p. 62, 108.

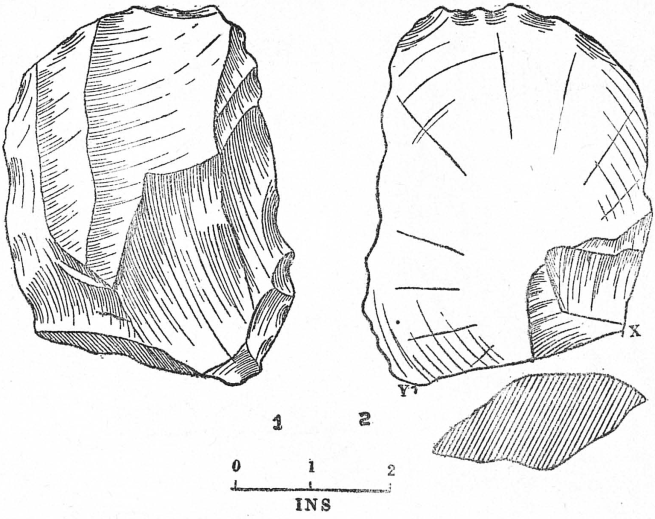
Fig. 31

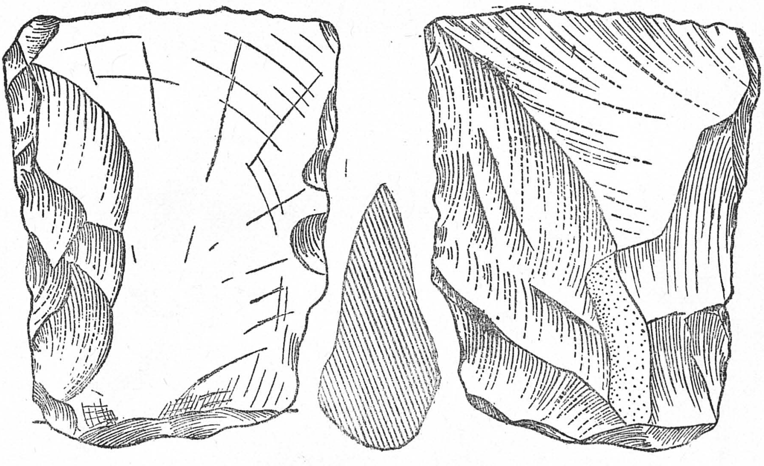


(CLEAVERS)

1, 2 (KD-426), Pl. V, p. 62, 108; 3, 4 (KD-422), Pl. V, p. 62, 109.

Fig. 32



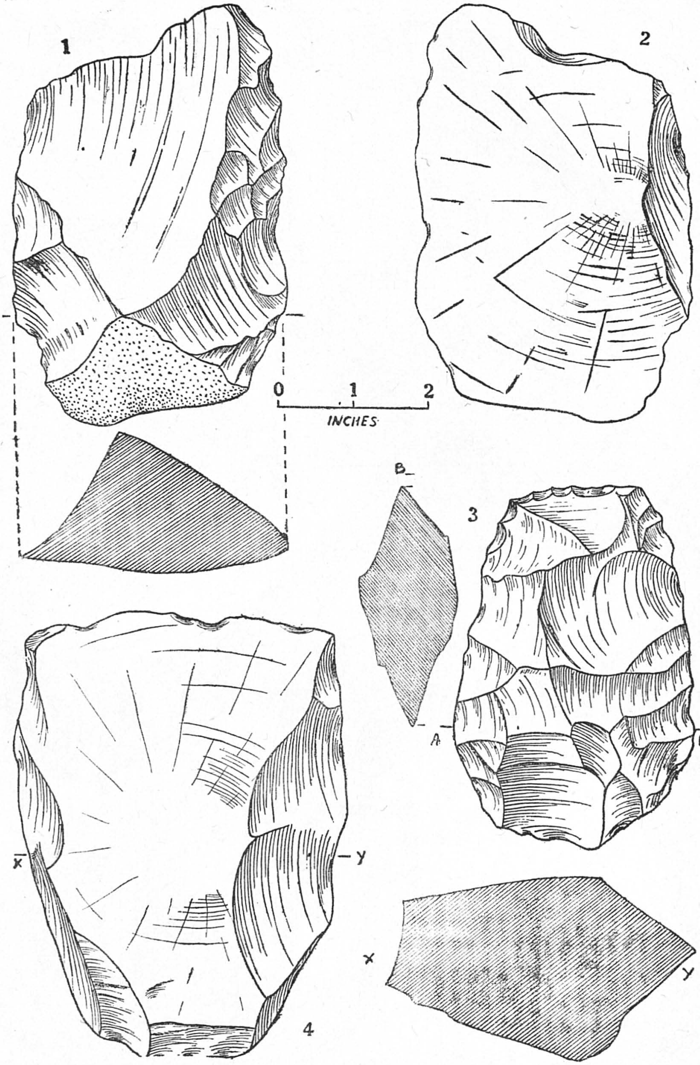


3 4

(CLEAVERS)

1, 2 (KD-466), p. 62, 109; 3, 4 (KD-419), p. 62, 109.

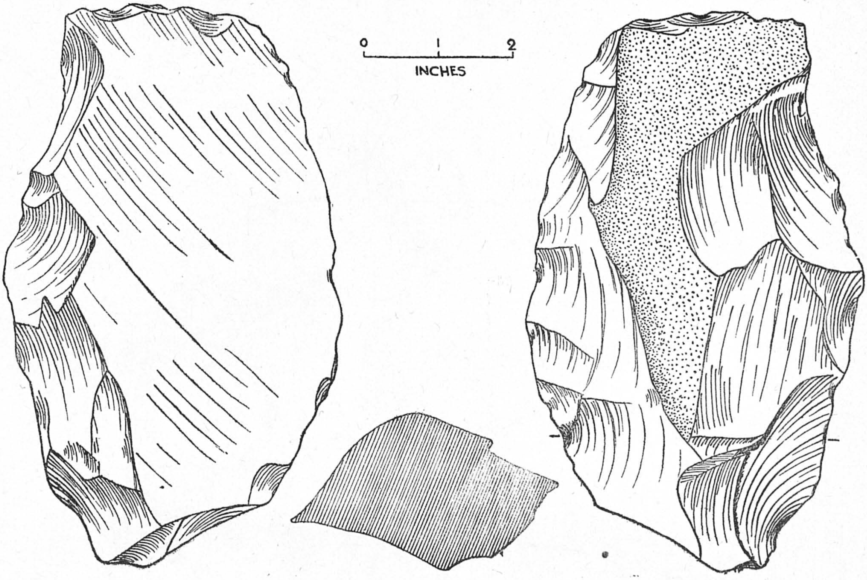
Fig. 33



(CLEAVERS)

1, 2 (MNI-74), p. 62, 109; 3 (KD-333), Pl. V, p. 63, 110; 4 (KD-388), p. 63, 109.

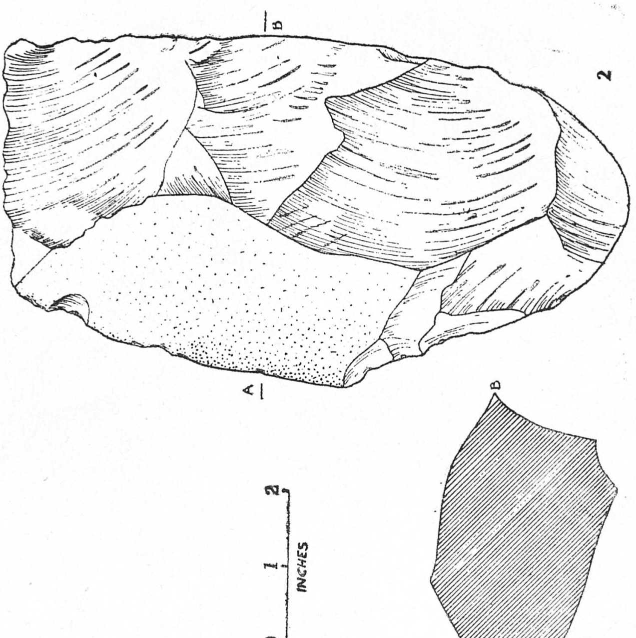
Fig. 34



(CLEAVER)

(MNI-151), p. 63, 110.

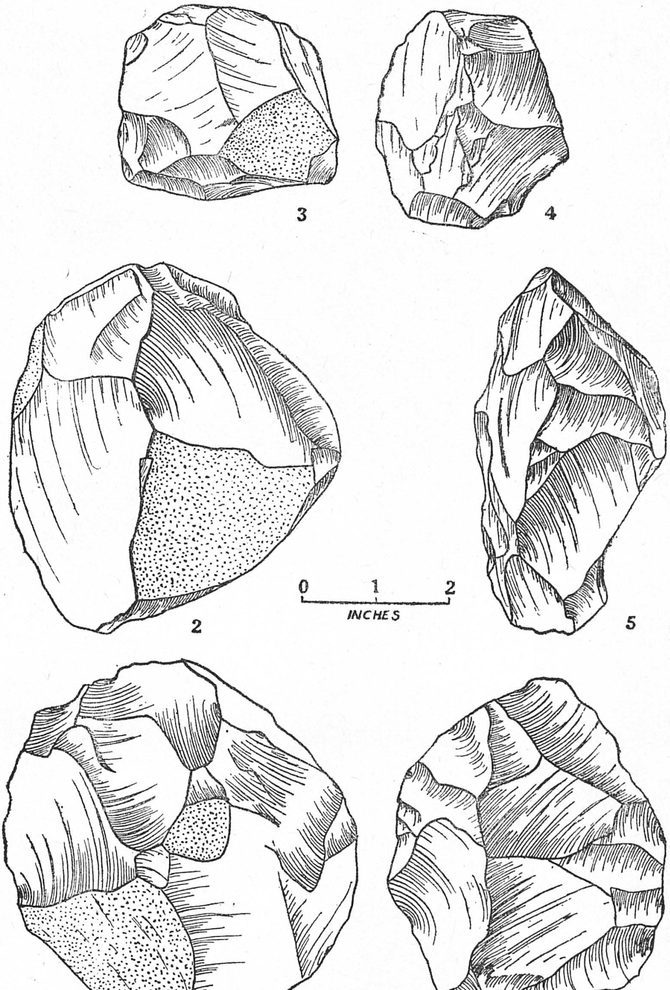
Fig. 35



(CLEAVER)

(MNI-152), p. 63, 110.

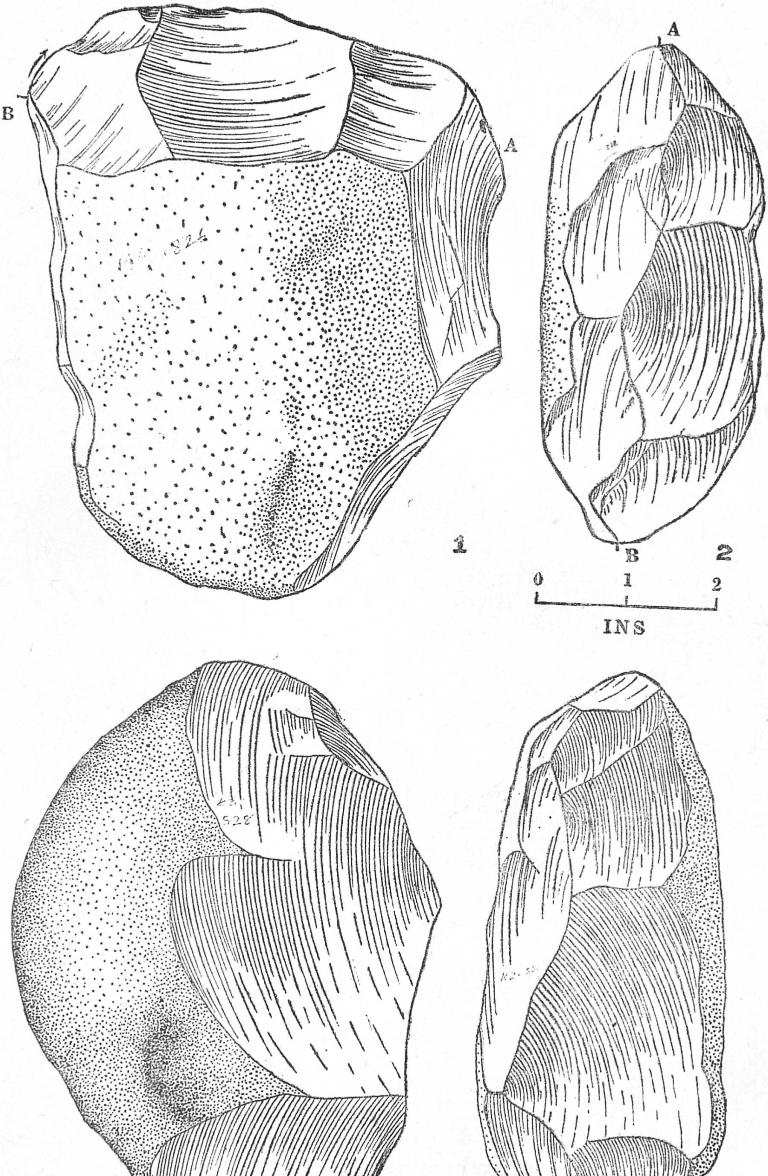
Fig. 36



(CORE, CHOPPER AND SCRAPER)

1, 2 (KD-220), p. 64, 110; 3, 4 (TML-249), p. 64, 111; 5, 6 (KD-y) core-scraper.

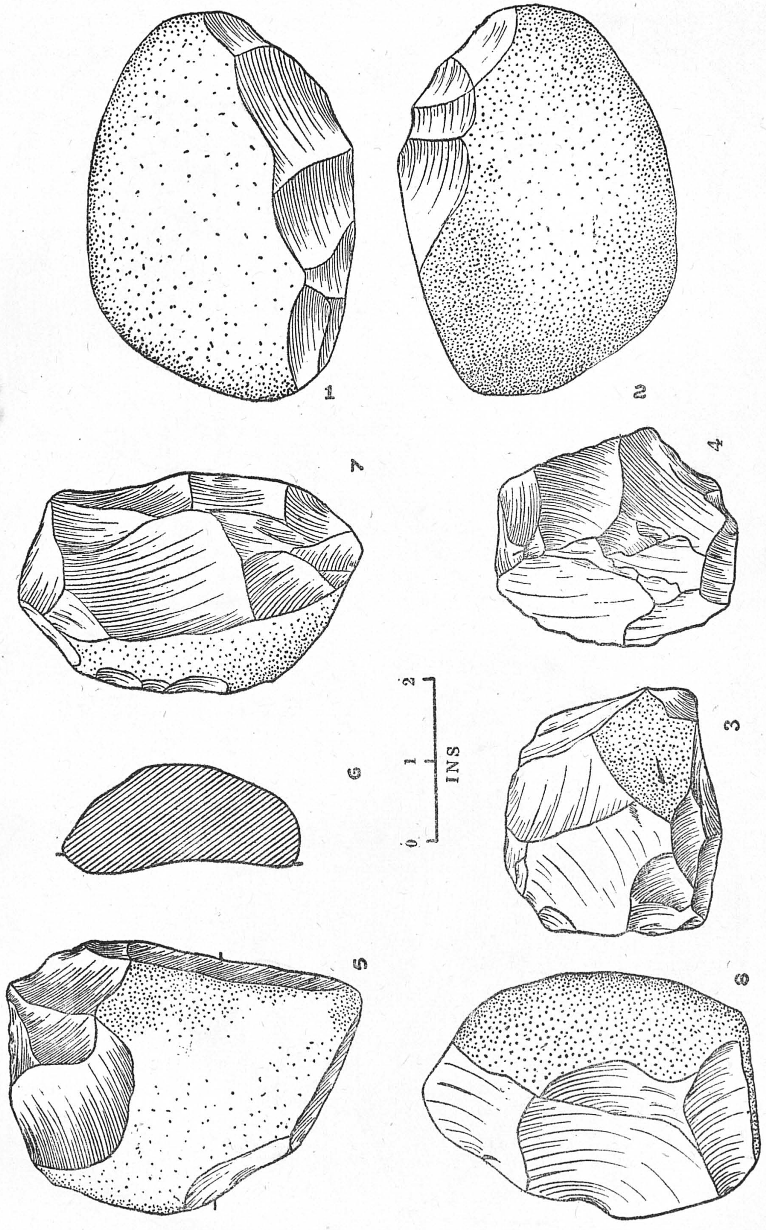
Fig. 37



(CHOPPERS)

1, 2 (M-Gorge-826), p. 64, 111; 3, 4 (KD-528), p. 64, 110.

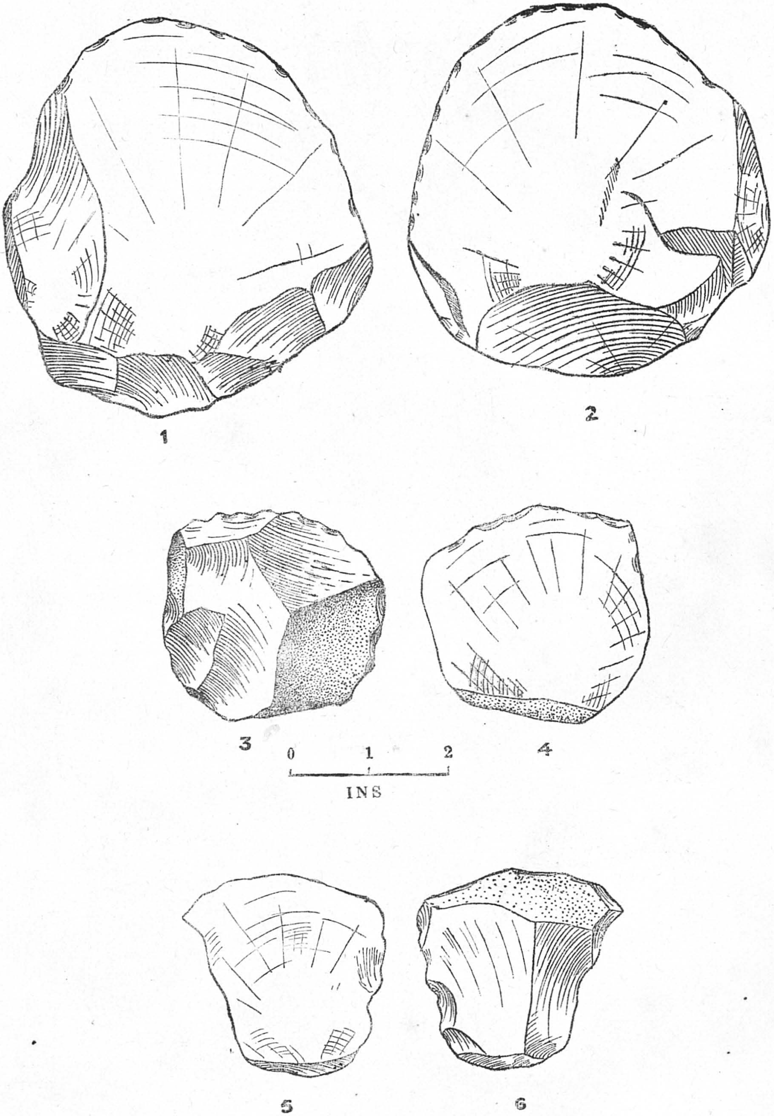
Fig. 38



(CHOPPERS AND SCRAPERS)

1, 2 (524), p. 64, 110; 3, 4 (TML-249), p. 64, 111; 5, 6 (CMG-790), p. 64, 111; 7 (ATD-760), p. 64, 111; 8 (CMG-791), p. 64, 111.

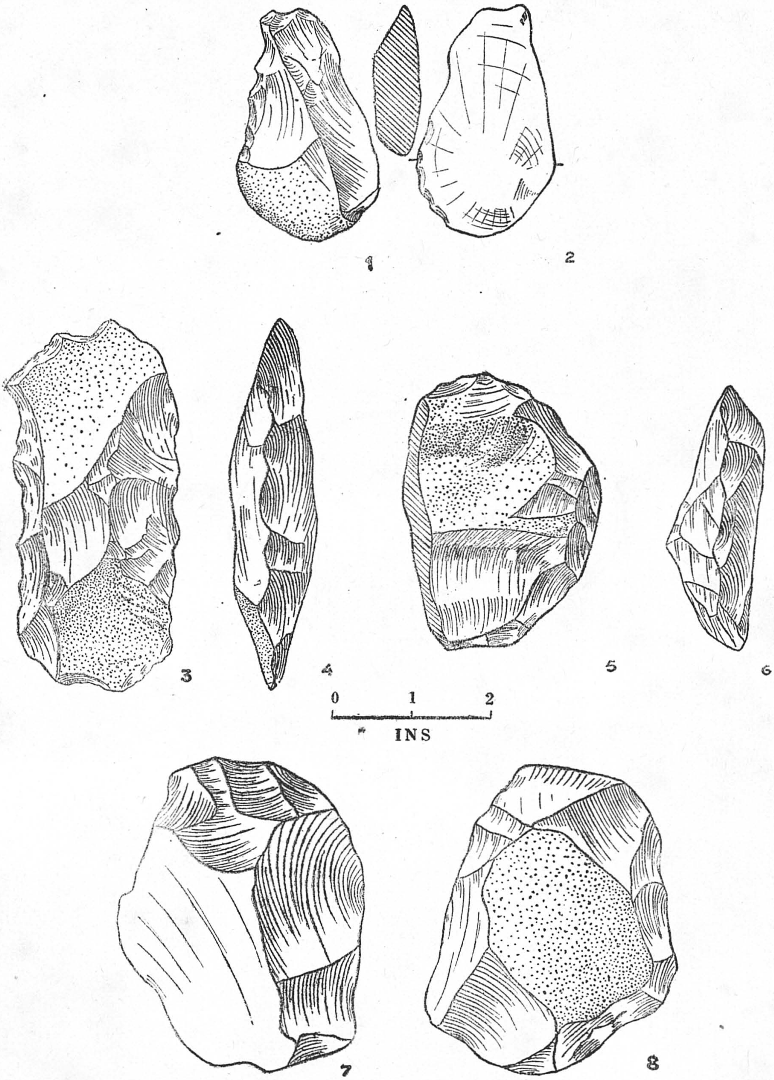
Fig. 39



(FLAKES)

1, 2 (MNI-164), p. 65, 111; 3, 4 (KD-547), p. 65, 111; 5, 6 (TML-270), p. 65, 111.

Fig. 40



(FLAKES)

1, 2 (CMG-776), p. 65, 111; 3, 4 (MRI-717) p. 65, 112; 5, 6 (H-Tag), p. 65, 112;
7, 8 (M-Gorge), p. 65, 112.

Fig. 41